

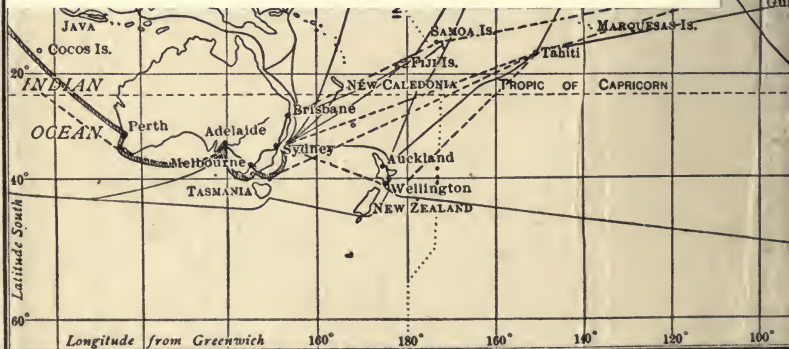
PANAMA AND ITS BRIDGE OF WATER



NIDA

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**PANAMA
AND
ITS
“BRIDGE
OF WATER”**

"The Isthmus of Panama, formerly a part of Castella del Oro, is the gateway to the Pacific and the front door of the three Americas, to which the Antilles lead up as stepping stones. For migration, commerce, or war, the Isthmus of America, with or without a canal, is the most important strategic point in the world."



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PANAMA AND ITS "BRIDGE OF WATER"

By
STELLA HUMPHREY NIDA
)

Illustrated

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THE CONTENTS

	PAGE
<i>A Foreword</i>	9
<i>The Introduction</i>	11

PART I

THE LAND OF THE PANAMANIAN

INTRODUCTORY	17
EARLY HISTORY	
The Arrival of the Spaniards	21
THE BUCCANEERS	
When Drake and Morgan Sailed the Seas	32
GEOGRAPHY OF THE ISTHMUS	
Panamanian Products and People.	42
THE PANAMA RAILROAD	
The First Railroad across America	63
PREPARATIONS FOR A CANAL	
The Beginnings of a Great Waterway	70
DE LESSEPS' FAILURE	
A Costly Experiment	78

PART II

COMING OF THE AMERICANS

CLEANING UP THE CANAL ZONE	
War on Disease, the First Great Task	87

	PAGE
THE GATUN DAM AND THE LOCKS	
The "Steps" to the "Bridge of Water"	100
CULEBRA CUT AND THE SLIDES	
A Knotty Problem	111
HOW THE GOVERNMENT CARED FOR HER EMPLOYEES	
The "Labor Question" Answered	126
LEADERS IN THE PROJECT	
The Men to Whom We Owe the Panama Canal	148
THE ZONE A MILITARY RESERVATION	
How "Uncle Sam" Protects His Interests	166
THE CANAL AS A COMMERCIAL HIGHWAY	
How It Promotes Our Trade	174
THE PANAMA-PACIFIC EXPOSITION	
America's Triumphal Celebration	182
<i>A Guide to Pronunciation</i>	188
<i>The Glossary</i>	189
<i>Suggestions to Teachers</i>	191
<i>A Bibliography</i>	195

A FOREWORD

THE story of a raging stream made navigable, of a mountain chain bridged by an artificial stream of water, of climatic conditions overcome, and of swamps and jungles made a healthful dwelling place reads like a romance, but such is the history of the building of the Panama Canal. It was the conviction of the author in writing this story for young people that it should be a familiar tale to every school child of the grammar grades.

The geography and history of the past is largely the story of man adapting himself to natural conditions. In the old days physiographic features, such as rivers and mountains, determined routes of travel and commerce. While their effect is still important, the coming of steam and electric power has helped man to conquer nature to an astonishing degree. Deserts are traversed by the iron horse, rivers spanned by monster bridges, and mountains pierced by tunnels. Arid regions are irrigated and made to yield abundantly and great hills are leveled to plains. The men of the future, instead of searching for natural routes, will go about making their own where they will. The explorer has given place to the engineer.

This gives a new trend to the study of geography. Emphasis is now placed upon the human side of

geography, upon the mastery of the world's trade routes. For instance, rivers that are of commercial value have a human interest, while little attention is paid to those that are not navigable, because they are of no service in the progress of mankind. The conditions that have helped to make a city great are of more importance to us than the mere fact of the city's greatness, for we shall always be building other great cities.

To build the Canal required the best thought of scientists, engineers, and statesmen. Hundreds of our citizens who were American school children a generation ago played an important part in the undertaking. It took courage, honest service, unselfishness, and great faith to gain this superb conquest. What better ideals for our coming citizens?

S. H. N.

THE INTRODUCTION

THE building of the Panama Canal brought together on the Isthmus a great army of men, splendidly organized and pursuing a peaceful conquest with all the energy, valor, and heroism that might characterize a decisive battle in warfare. But instead of an opposing army of regiments, the attack was directed against mountains, swamps, and diseases.

The results of that conquest, as measured in terms of service to our country, can be compared only to the heroic services of our greatest wars. As a nation we are indebted to every man who faithfully performed his duties on the Canal. Many endured privations, and some even met death, but always with the same dauntless courage that has ever led men of like spirit to charge the ramparts of an enemy.

It was a battle against nature,—and the patriotism revealed was as strong and as real as has been any in our proud history. As a national achievement it is worthy of primary consideration in our public schools, and in providing this school text the author has made no small contribution to our nation's good. She has possessed the "Canal spirit" to a remarkable degree, and has given the narrative vividness in spite of its broad scope. The text is, in itself, a tribute to the author's exhaustive and discriminating study

of the world's greatest and most fascinating campaign of engineering. Having the advantage of a personal acquaintance with varied features of the Canal enterprise, I am convinced that this book will give to the school children a correct understanding of the subject, and will increase their interest in, and respect for, our nation's greatness.

The history of any great achievement is the biography of its leaders. The story of the Panama Canal is the record of the deeds of great men who were supported by the patriotic devotion of an army. The Canal record of brilliancy and honor is a long one, and no page stands out with more credit to the American nation than that one which records our government's marked interest in the highest moral, as well as physical, welfare of the men whom she sent into most trying and depressing conditions in the heart of the tropics. Such an expression of Christian ideals has been noted by the nations of the world as truly as our achievements in sanitation and engineering.

A. BRUCE MINEAR

*Superintendent of Club Houses
and
General Secretary, Y.M.C.A.*

PART I



THE LAND OF THE PANAMANIAN

"When the last dike was blown up at Gamboa and the water of Gatun Lake was allowed to rush into the Cut, it marked a new era in the history of the race. For countless ages the narrow strip of land which is the Isthmus had been soaked with human blood—sodden with the romance of olden days. This Canal of ours stands for the new and better times. The old romance of brawn and blood has given place to the romance of brains."



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*S.S. "Cristobal," the first ocean-going liner to pass through
the Panama Canal*

PANAMA AND ITS "BRIDGE OF WATER"

INTRODUCTORY

ON the seventh day of January, 1914, a certain boat made a short voyage of fifty miles in which all the world was interested. This boat, by sailing through the new Panama Canal from the Pacific Ocean to the Atlantic, proved that the United States government had successfully completed the most wonderful piece of engineering known to history.

The Panama Canal cuts in two the Isthmus of Panama, which joins North America and South America. It would take a railroad locomotive going at ordinary speed less than two hours to travel across this narrow isthmus, but, strange as it may seem, this fifty miles of waterway has cost the United States \$375,000,000 in money, six thousand lives,

and ten years of the hardest and bravest struggle.

It is difficult to think in terms of millions. Can you imagine every man, woman, and child in the United States bringing four silver dollars and placing them in a heap? It would be a mountain of money, and it would take it all to pay for this wonderful Canal. It would take seven millions of these dollars to pay for one mile of the Canal, or about six thousand dollars for a strip of it as long as your foot ruler.

The Canal will be of great value to the world's commerce by shortening the distance from the western coast of Europe and the eastern coast of the United States to the western shores of North and South America and to the coasts of Asia and Australia. It will save a great deal of time and money. In order to pay for its upkeep it must earn more than a million dollars a month by charging ships a toll for their passage.

For four hundred years the world has been

wishing for a canal across the Isthmus. Why was it not built long ago? Our government



Adapted from Barrett, "Panama Canal: What It Is, What It Means"

The same amount of excavation as that of the Panama Canal would make a tunnel, 14 feet in diameter and 8,000 miles long, which would cut through the center of the earth

is tunneling beds for rivers through mountains, building great artificial lakes, and reclaiming miles of sandy desert larger than the whole Isthmus of Panama. Why was it so stupendous a task to build this short strip of waterway? Let us go back four hundred years, and learn the whole story of the enterprise.



*Christopher Columbus, from a portrait supposed to have
been painted by Jan Van Eyck of Bruges*

EARLY HISTORY

THE ARRIVAL OF THE SPANIARDS

Columbus spent some time on his last voyage to America sailing on Limon Bay, which is at the Atlantic entrance to the Canal. He also explored the Chagres River. Columbus is usually given credit for first exploring the Isthmus of Panama, and the two cities of Colon and Cristobal are named for him. Four years before this time, however, another



The voyages of Columbus to the New World

22 Panama and Its "Bridge of Water"

Spaniard, Rodrigo de Bastides, had visited the shores of the mainland of America at the



The "Santa Maria," the flagship of Columbus

Isthmus. With him was Balboa, who later became governor of the first settlement at Nombre de Dios in 1509.

The settlement at Nombre de Dios was the first made on the continent of America. It was founded fifty-four years before the settlement at St. Augustine, and nearly a hundred years before that at Jamestown. So Panama is the white man's first home in America.



A portrait of Balboa, published by courtesy of the "Bay View Magazine" and the Pan American Union

Balboa is said to have been the first white man to discover the Pacific Ocean. He



Brown Bros., photographers
Balboa's discovery of the Pacific. Leaving his followers on Darien Heights, Balboa waded into the ocean and took possession in the name of the sovereign of Spain

married an Indian princess, and profited by it, for the Indians became his fast friends. They kept telling him of the gold and precious stones he might obtain not far away on the other coast, but for some time he was afraid to cross the mountainous jungle. At last he started out with one hundred and



Routes of early voyagers to Panama

26 Panama and Its "Bridge of Water"

ninety men. They traveled very slowly, at the rate of about two miles a day, and reached



Courtesy of the Pan American Union

*Balboa taking possession of the Pacific in the name of Spain,
from the bronze frieze in the Pan American Building*

the Pacific coast in September, 1513. Balboa took possession of the ocean in the name of Spain, and called it the "South Sea."

When he returned to Nombre de Dios, about five months later, he found in his place a new governor, named Pedrarias. The two men did not get on well together. Balboa made other trips to the Pacific, carrying the parts of ships. These he put together again, and sailed upon that great body of water. But in 1519 Pedrarias succeeded in

having him beheaded under a false charge, and the real founder of Panama was no more. In the year of Balboa's death—a whole century before the Pilgrims landed at Plymouth—the old city of Panama was founded on the Pacific coast.

In 1532 Francisco Pizarro led an expedition southward from Panama on the Pacific coast and conquered the Incas, a remarkable tribe



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*"Flat Arch" ruins of Santo Domingo church, city of Panama.
This arch, said to be the longest flat arch in the world,
has stood more than two hundred years*

28 *Panama and Its "Bridge of Water"*

of Indians who lived in splendor in the mountains of Peru. They had immense



Francisco Pizarro, from an old engraving

treasures of gold and silver and jewels which adorned their temples, and all this wealth fell into the hands of the Spaniards. Extensive

mines of gold and silver were discovered, and soon great quantities of the precious metals were being carried to Spain by way of Panama.

To get this treasure to Spain more easily the Royal Road was built across the Isthmus. This road was paved with stone and extended between the cities of Nombre de Dios, Porto Bello, and Panama. It was said to be wide enough to accommodate two carts abreast, but it was used chiefly by the trains of pack mules that crossed in caravans, carrying treasure and merchandise to and from the king's ships.

After the palaces and the temples of the Incas were stripped of gold, the silver mines of Peru yielded great wealth. Pearls were brought from the islands in the Pacific, precious stones from the Andes, and dyewood from the coast was exchanged for the merchandise brought from Spain to the colonists. The Spanish galleons, or warships, armed with from forty to fifty guns, guarded the fleet of

30 *Panama and Its "Bridge of Water"*

merchantmen that every year carried the king's treasure across the Atlantic to Spain,



C. M. Peacock, photographer

A cave near the site of the old city of Panama which is believed to have been used as a hiding-place for treasure

for the course was beset with pirates. The English allowed the Spaniards to encounter all the hardships in securing the treasure, and then lay in wait to take it from them.

Although Morgan and Drake were just plain, everyday pirates, Morgan was actually knighted for his daring robberies on the seas and on the Isthmus. Morgan and Drake

justified their unlawful deeds by claiming that England was at war with Spain, and there was also the feud between the Protestants and the Catholics to offer as an excuse for this lawlessness.

About a hundred years after the founding of Nombre de Dios the Spaniards settled Porto Bello in a more healthful spot on the Atlantic coast, and removed bag and baggage to this fine port. A yearly fair was held regularly at Porto Bello, and at that time the people crowded there for several weeks, while the mule trains were arriving from Panama and the treasure was being loaded upon the king's ships. Merchants exchanged their wares for the products brought by the colonists, and the trade grew year by year, until, it is said, it reached the immense sum of two hundred million dollars. For many years Spain lived on the wealth brought from America and the Peruvian mines.

THE BUCCANEERS

WHEN DRAKE AND MORGAN SAILED THE SEAS

SIR FRANCIS DRAKE, when a lad of eighteen, sailed on the West Indian Seas with his uncle. They nearly lost their lives through the treachery of the Spaniards, and for the rest of his days Sir Francis seems to have devoted his energies to getting even with that hated nation. A few years later, when he had obtained a vessel of his own, he landed with a troop of young men at Nombre de Dios. He captured the batteries, and before the Spaniards knew what he was doing, he had secured a position where he could charge on the city. Instead of resisting, the Spaniards fled. When Drake's men found the treasure house so easily at their mercy, they scarcely knew how to proceed, and just as all the wealth was within their grasp they lost their heads.



Sir Francis Drake

A drenching tropical shower came up suddenly and with such fury that they thought they were all going to be drowned. Drake, who had received a slight wound in the skirmish, fainted, and his men fled in confusion, dragging him with them back to their ships and carrying away only a small part of the booty within their reach.

When Drake revived he was naturally very much chagrined at the outcome, but he went to work on a plan to waylay on the Royal Road one of the mule trains due to cross the Isthmus with the court treasure at about this time. He first made friends with the Maroon Indians, who served as his guides. Under their direction, Drake's men made the trip safely to Cruces, about half-way across the Isthmus. A little beyond this point they lay in wait for the treasure train. Soon mule bells were heard tinkling on the Royal Road. All made ready, and the surprise would have been complete had not one of Drake's men misunderstood one

of the signals given and allowed himself to be seen by one of the Spanish horsemen.



King Bros., photographers

Cathedral tower of St. Augustine. The church of which the tower formed a part was destroyed by Morgan, 1671

At this the Spaniards became suspicious and advised a ruse. Usually the treasure of the caravan was carried by the first fourteen mules, which went well in advance. In this case these were sent to the rear, and mules loaded with grain and baggage were driven on ahead. When Drake's men fell upon the baggage train the mules in the rear were made

36 *Panama and Its "Bridge of Water"*

to retreat, and were hurried back to Panama at full speed, thus saving the treasure.

When Drake realized that he had been outwitted he let it be understood that he had left the Isthmus; but instead of doing this he joined a French pirate. Then, with a small body of men they hurried back toward Nombre de Dios. Here, within hailing distance of the town, they seized another mule train and secured one hundred thousand



C. M. Peacock, photographer

*All that is left of old Spanish cannon as they fell from their
rotting carriages at Porto Bello*

dollars in gold and silver. The story goes that a large part of this booty had to be hastily buried before the Spaniards recovered and came back to retake their treasure. Later, Drake raided Nombre de Dios again, and burned the city.

Drake's raids were second only to those of Henry Morgan, another Englishman, who, a few years later, attacked Porto Bello. He blew up the fort, with all the soldiers inside. He made the nuns and friars prisoners, and forced them to place against the walls of the castle the scaling ladders, by means of which he captured it. For fifteen days he tortured the colonists, but at last accepted a ransom of twenty-five thousand dollars and returned to the West Indies,



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*Watchtower, old fort,
San Lorenzo*

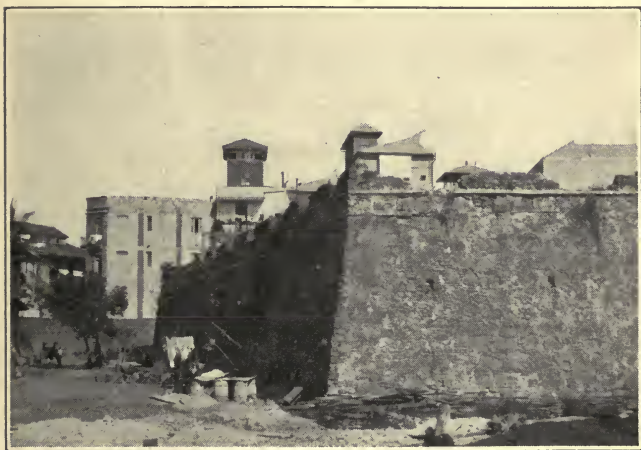
38 *Panama and Its "Bridge of Water"*

where he spent the money in riotous living.

When this money was gone, Morgan took San Lorenzo near the mouth of the Chagres River and crossed the Isthmus to take the city of Panama. Without the leadership of the Indians who assisted Drake, Morgan and his men suffered greatly on the march across the Isthmus. Lost in the jungles and the swamps, much of the time without food, they were bitten by poisonous spiders and snakes, trapped in the quicksands, and made ill with fever. They reached Panama in a weak and wretched condition. On the savannas before the city were the cattle of the Panamanians. Morgan's men killed these and gorged themselves on the meat before it was half roasted.

When at last they succeeded in entering the city they found that ships had been loaded with the treasure and valuables of the natives and that these ships had disappeared. Some writers say that they had been sunk in the harbor. At any rate, the

treasure was safe from the buccaneers. Morgan took his revenge by torturing the citizens,



C. M. Peacock, photographer

A remnant of the old Spanish colonial fortifications. These cost so much that King Philip is reported to have said they ought to be visible from his palace in Madrid

killing many of them. Then he burned the old city of Panama to the ground.

The new city of that name, which is now nearly two hundred and fifty years old, was built several miles from the old city at a point where it could be strongly fortified.

For many years the Spaniards invaded Mexico, Central America, and South America,

40 *Panama and Its "Bridge of Water"*

not for purposes of agriculture—though there is no place where the earth gives back so much for so little labor—but to establish towns where they could sell their merchandise. For a century or more, the wealth obtained from Peru and the Pacific islands was carried across the Isthmus to the coffers of Spain, until the mines were at last exhausted. Then the richest highway the world has ever known, the Royal Road, was



C. M. Peacock, photographer

*An old Spanish bridge on the road from old Panama to
Panama City*

allowed to grow up to jungle vines and flowers.

To-day the Royal Road may be seen in spots



C. M. Peacock, photographer

Ruins near the old city of Panama

near the Canal Zone, though its course, like the route Balboa is said to have taken, lies in some places many miles from the Zone.

GEOGRAPHY OF THE ISTHMUS

PANAMANIAN PRODUCTS AND PEOPLE

AS we have said, the Isthmus of Panama is a narrow strip of land connecting North America and South America. Unless we study the map, however, we are sure to think of it as extending north and south, when in reality it extends nearly east and west. It sounds very strange to people living in the United States to speak of the sun rising in the Pacific Ocean and setting in the Atlantic, but this is actually the case at one place on the shores of Panama Bay; for the Gulf of Panama is an arm of the Pacific and lies directly east of a portion of the Caribbean Sea, which is a part of the Atlantic Ocean. When Balboa crossed the Isthmus he went in a southerly direction, and that is why he called the ocean he discovered the South Sea.

All this is to help us remember that the



Map of the Republic of Panama

44 *Panama and Its "Bridge of Water"*

Canal takes a southeasterly direction from Colon on the Atlantic coast to Panama on the Pacific. If we want to fix the city of Panama in our minds we can think of it as being due south of Buffalo, New York, or Pittsburgh, Pennsylvania.

Perhaps you will be surprised to know that the Canal is not built across the narrowest part of the Isthmus, which is at the Gulf of San Blas, sixty miles east of Colon. At that point it is only thirty miles wide. Why did we choose a route twenty miles longer?

In the first place, by the San Blas route there is no large river to help furnish the waterway, so the amount of digging would have been much greater, because the "backbone of the continent" is more than twice as high at this narrow part. Besides this, there has never been a road of any kind made through the jungle at San Blas, while at Colon there was a beaten path, some of it four hundred years old. The railroad which had been built at Colon was also a deciding factor.



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*Falls on the Rio Chorrera, about twenty miles west of
Panama City*

The Republic of Panama is a trifle smaller than the state of Indiana. It is composed of seven states, the most important of which are Bocas del Toro, Chiriqui, Colon, and Panama. Panama comprises one third of the whole republic, and across this state stretches the Canal Zone.

The Canal Zone is a strip of land extending five miles on each side of the middle line of

the "big ditch." It is, therefore, ten miles wide and reaches from deep water in one

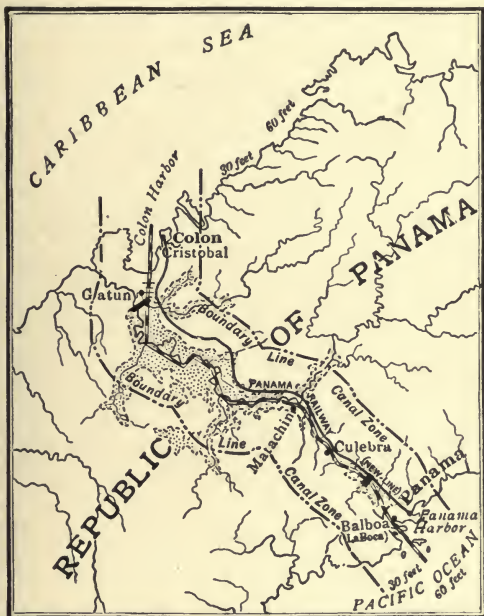


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Native soldiers who help guard the Republic of Panama

ocean to deep water in the other, or a distance of about fifty miles. Over this Zone the United States government has absolute control, except for the two Panamanian cities

of Colon on the Atlantic coast and Panama on the Pacific. However, the United States



Map of the Canal Zone

has the right in these cities to dictate all measures relating to sanitation and health.

The state of Panama is only nine degrees, or some six hundred miles, from the equator, so it has a tropical climate. Though the

48 *Panama and Its "Bridge of Water"*

thermometer at times registers high, it seldom averages above eighty-six degrees. Dark-



A bird's-eye view of the Canal Zone

ness falls suddenly, without twilight, in Panama, and the nights are always comfortable.

It is sometimes said in joke that there are two seasons on the Isthmus, a rainy and a wet, but this is somewhat exaggerated. However, the rainfall on the Atlantic coast is about *twelve feet* yearly. On the Pacific it is about half as much.

January, February, March, and sometimes April are the only dry months. About the first of April or May light showers fall daily, or very often, and from June to December come regular "gushers."



Photograph from the New York Zoological Society
*The South American Tapir, a wild animal
of Panama whose home is among
the forest trees*

The sun shines brightly between showers, but work is suspended during the downpours. Sometimes several inches of rain fall within a few hours, which makes raging torrents of the streams and keeps the vegetation always green and luxuriant. It also keeps the ground in a swampy condition. In some places the swamps are hundreds of feet deep.

Grass grows so easily here that fresh-turned earth is green again in a few days.

50 Panama and Its "Bridge of Water"

Seventy-five varieties of orchids grow wild, with a great variety of coleus and other



Photograph from the New York Zoological Society

A queer animal that lives mainly on ants, and from this peculiarity gets its name—the Great Ant-Eater

tropical plants. One season's growth buries everything, even houses, if undisturbed. A French village large enough to shelter a thousand people was dug out of the jungle after only a few years of desertion.

Many fruits—bananas, coconuts, alligator pears, mangoes—grow wild. The big-animal life of Africa is not found in Central America, but insect life is here in great variety. Tapirs,

ant-eaters, the iguana or lizard, and other queer animals abound, while deer and tiger



Photograph from the New York Zoological Society

The Iguana, one of the largest of the lizards, is a harmless creature despite its hideous appearance

cats live on the mountain sides, and the streams have many alligators. Paroquets, humming birds, and the beautiful white heron are common, as are all sorts of tropical birds of brilliant plumage. The bites of the poisonous spiders, the scorpion, and tarantula are fatal to their victims unless promptly treated with an antidote. The coral snake, too, is very common. After the Americans

came, the Canal Zone was soon cleared of dangerous animal life, the chief of which

was the mosquito.



Photograph from the New York Zoological Society
*The Tamandua, one of the smaller species
of ant-eater*

The natives are usually of mixed nationalities—Indians, negroes, and Spaniards. The Spanish lan-

guage is spoken, as a rule. Most of the Indians living on the Isthmus were enslaved by the Spaniards in the early days and thus lost their identity, but there is still one tribe, known as the San Blas Indians, who boast that no white man ever stayed all night in their territory. Their women are most carefully guarded and are seldom seen. The men come to the Zone to exchange coconuts for salt and other commodities.

The native Panamanian of the lower class

takes life as easily as possible. Perhaps one bright day two young natives walk off together



Photograph from the New York Zoological Society
The nine-banded Armadillo, one of the best-known of tropical American animals

and with a few poles build a thatched hut in the jungle, and set up a home. Whatever they lack they borrow from their neighbors who have been housekeeping for a longer period. Their food consists chiefly of bananas and coconuts, which grow about them in the wild state. They do very little cooking and wear little clothing. As their family grows up, the children help gather the food that grows wild for them, without labor; and

since there is no effort made by one family to outshine its neighbors, there is little to



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A charcoal seller

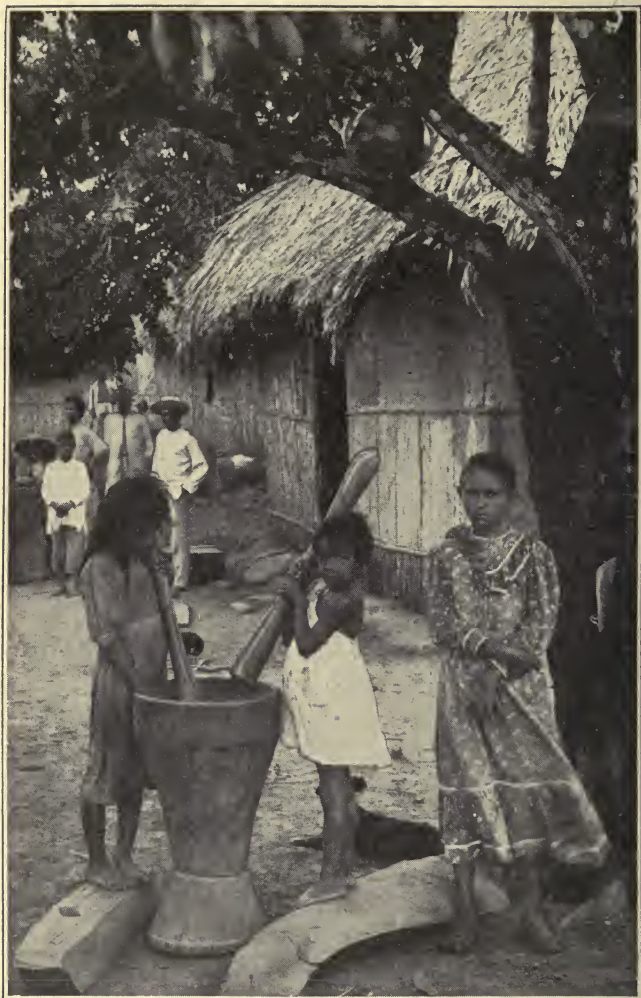
do but sleep and eat. Soon this family helps start others to house-keeping, and so their lazy, simple life goes on. The natives of the tropics are not subject to the fevers and other maladies that assail foreigners.

Two thirds of the Isthmus is wooded. There is a great variety of undergrowth and many valuable hard woods, like mahogany and ebony. Perhaps a native will hollow out for his canoe a mahogany log that would be worth thousands of dollars for furniture in the United States. It is said that some of the railroad ties in the early days were made of these valuable hard woods and were dug up years afterward in perfect condition.



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Native Indians in their long "dug-outs" or cayukas. These "boats" are hollowed out of a single log and are paddled or poled from the stern



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Cholo Indians in the interior of Panama pounding rice in a wooden mortar

We wonder, perhaps, why these costly woods are not brought to the United States,



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A street in a native village just outside the Canal Zone

where they are so highly prized. There are several reasons. In the first place, if a man or a company is ready to buy land in Panama it is almost impossible to get a title to it. Then there are no bridges or roads reaching back into the country to help in getting products to the coast where they may be shipped, and it is just as difficult to get machinery and provisions into the country as it is to



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*Wash day on the Isthmus. The usual way the work is done
by the natives*

get the products out. The third and worst trouble is the labor question. The natives



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Homes in the banana belt. Here Nature provides nearly everything the native needs and he will not work

will not work, no matter how much money you offer them. It is said a native family is well supplied when the man works two days a week, and he has no thought of laying up anything for the future. Very often the father of a family starts off to town and does enough work on the way to buy a few

60 *Panama and Its "Bridge of Water"*

needles or furnish his other simple needs.

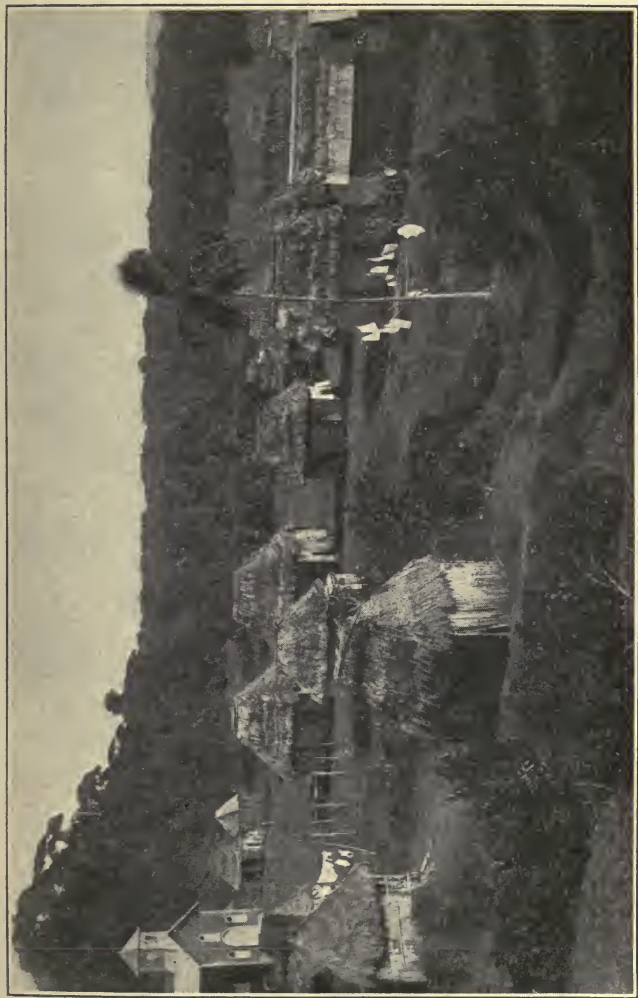
The banana industry of the United Fruit



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Unloading bananas for the northern markets. These are brought from the interior in the "dug-outs" or cayukas of the Indians

Company in Bocas del Toro is the biggest enterprise in the republic. The company controls good harbors and brings its labor from the West Indies. The Darien Gold-Mining Company runs a small steamer every week to Panama. They also bring their



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Native village at the mouth of the Rio Chagres, on the site of the old town of San Lorenzo

62 *Panama and Its "Bridge of Water"*

labor from abroad, but the cost of transportation eats up their profits. Pineapples, coconuts, vegetable ivory, rubber, cacao, and the cabinet woods will some day be shipped in quantities to the United States.

Pearl fishing on the southern coast is now a profitable industry. The mother-of-pearl alone pays the expense of collecting and the real pearls are clear profit. Twenty or thirty ships with their diving apparatus are constantly at work pearl fishing among the islands and up and down the coasts.

There are fine rubber trees growing wild in Darien. Cattle raising is a paying industry, for the many juicy grasses feed cattle very cheaply and they can be driven to a shipping point. At Boquete is a colony raising coffee.

THE PANAMA RAILROAD

THE FIRST RAILROAD ACROSS AMERICA

THE first railroad to cross the American continent was that built across the Isthmus between Colon and Panama City. Probably it was the costliest railroad ever built, for less than fifty miles of track cost the builders seven million dollars or about \$140,000 a mile. More than this, it is often stated that every tie of the railroad cost a human life. However much this may be exaggerated, it is true that thousands of lives were sacrificed to the undertaking.

The work was begun in 1850 by three Americans,—Aspinwall, Chancy, and Stevens. The first train went over the track in January, 1855. Only eight miles of track in a year! But courage won. The first eight miles were the hardest to build. The men worked waist-deep in the swamps, chopping away the

64 Panama and Its "Bridge of Water"

tangled undergrowth with their lunches tied to their hats to keep them from mud and



C. M. Peacock, photographer

The re-located Panama railroad, looking south from La Pita cut, where the road is built on a high level around Gold Hill

insects. They were exposed to the bites of poisonous snakes and spiders, and crazed by swarms of mosquitoes. Hundreds died from fever and other diseases, and many slipped from sight forever in the treacherous quicksands.

The constant summer heat and rain, with

the decaying vegetation, send forth a poisonous vapor that is very trying to foreigners.



C. M. Peacock, photographer

A section of the embankment over which the Panama railroad crosses an arm of Gatun Lake

The Black Swamp, just out of Colon, is still regarded as a bottomless pit, while some of the swamps near the Atlantic coast are known to be from one hundred and eighty to two hundred feet deep. Tons of stone and cords of wood were put in to make a roadbed for the railroad, but the greedy earth swallowed them up and yawned for more. Part of the

road across the swamp was virtually built on an immense pontoon bridge.

Under these conditions it was next to impossible to secure labor. Many nationalities were tried without success. A band of Chinese that were brought over were so affected by the horrors of the jungle that hundreds of them committed suicide.

To build the fifty miles of track the builders had to overcome not only bottomless marshes but tangled jungles, raging streams, and rocky mountains, while disease and death lurked on every hand. The numberless streams made many bridges necessary. Most of the material used in the construction work was brought from great distances. Food, metal, and even ties were brought from the United States and England, for there was no way of preparing the wood already on the ground.

Next to the Canal itself, the building of the railroad was a most remarkable piece of engineering. It is said that the road earned two million dollars while it was being built. It

was about half done during the time that the gold seekers were rushing to California, and



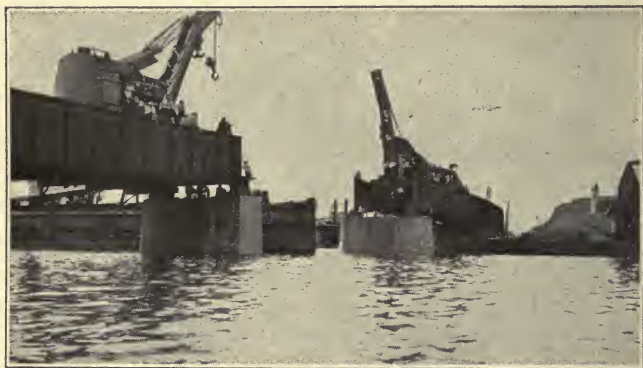
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*Lifting a span of the Panama railroad bridge at Gamboa to
allow the passage of a dredge up the Chagres River
arm of Gatun Lake*

because there was no other road crossing the American continent, many came by way of the Isthmus, riding as far as the railroad was completed and finishing the journey as best they might. In the early days, twenty-five dollars was charged for a single fare and five cents a pound for baggage; later, the rate was reduced to \$2.40 across the Isthmus, or five cents a mile.

68 *Panama and Its "Bridge of Water"*

When the United States built her first railroad across the desert in 1869 the profits



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Panama railroad bridge at Gamboa with span removed

of the Panama railroad declined. It was purchased by the French in 1881 for eighteen million dollars, and later sold to the American government when it took over the Canal project in 1904.

While work on the Canal was going on, seven passenger trains crossed the Isthmus every day. The trip could be made in less than an hour without stops; but the passenger trains were required to give the right

of way to the dirt trains, except on a very few occasions. Special engines and cars have to be built for this road, because it is a five-foot gauge, which means that the rails are five feet apart. In the United States, on the standard gauge, they are four feet eight and one half inches apart. The Canal played havoc with part of the roadbed, so that a great deal of money was spent to rebuild the road out of the way of Gatun Lake.

When a few gaps are filled there will be railroad communication through Mexico, Guatemala, and Nicaragua to Costa Rica, which last country joins Panama. In time, the Canal will be reached by rail from the United States. In connection with the railroad our government has had six ships plying between New York and Colon, which has been the only line to the Isthmus flying the American flag.

PREPARATIONS FOR A CANAL

THE BEGINNINGS OF A GREAT WATERWAY

THE project of making a canal across the Isthmus was first proposed to Charles V of Spain in 1523 by Cortés. Charles had sent Cortés to find a natural waterway across the Isthmus, which the Indians continued to tell the white men was there. Cortés, of course, failed to find a river that would allow him to reach the Pacific. He was evidently an enterprising fellow, for when he could not find what he wanted he proposed to his cousin, who accompanied him, that he draw some plans for an artificial waterway or canal which could be made at any one of four places. This cousin, Saavedra Ceron, was a civil engineer, so he proceeded to draw four sets of plans for a canal: one by way of Lake Nicaragua, one across Tehuantepec, one across Darien, and one across Panama.

Before these plans could be seriously considered. however, King Charles died.



Hernando Cortes, who, it is said, first proposed an Isthmian canal. From the portrait painted by Charles Wilson Peale, now in Independence Hall, Philadelphia

Another king, Philip II, who came after Charles, laid the matter before his friars for

72 *Panama and Its "Bridge of Water"*

counsel. They quoted their Bibles, saying, "What God hath joined together, let no man put asunder." So the Spaniards went on hunting for a natural waterway and for three hundred years the scheme for a canal rested.

In 1821 Panama became independent of Spain and was for many years subject to Colombia. Shortly after this, England got a foothold at Nicaragua and became interested in the Isthmus. In 1835 the United States began to realize that the Isthmus of Panama was of more value to our nation than it could possibly be to any other, and President Jackson investigated the problem of digging a canal across it. In 1848 he made a treaty with Colombia which gave the sole right of crossing the Isthmus "by railroad, road, or canal" to the United States. In return our government promised to protect the rights and powers of Colombia against other nations, and pledged herself to keep neutral (that is, not to use for warfare) any line of transit, or travel, that she should make across the

Isthmus. This made it possible to build the Panama railroad.

As England had her hands on a portion of the Isthmus, it was necessary for us to make a treaty with that nation. In this treaty, made in 1850, England and the United States both agreed that as *nations* they would not build a canal across the Isthmus for fifty years, or allow any other government entrance to the Central American country for that purpose. However, they jointly promised to protect any *private* company that would undertake the work.

There were many things that made the building of a canal difficult. In the first place, the Colombian government was suspicious of foreigners and very hard to deal with, and although it was only fifty miles across the Isthmus, every mile offered a tremendous obstacle.

The first of these was the Chagres River, which is a large stream rising in the San Blas Mountains. It runs for some distance parallel

74 *Panama and Its "Bridge of Water"*

with the coast in a zigzag course midway between the two oceans. When within a few miles of Colon it originally turned at right angles and emptied into the Caribbean Sea. For a stretch of seventeen miles from the sea the bed of the river was only a trifle above sea level; but from Bohio to Culebra Cut it rose to forty-eight feet above sea level. The Chagres River crossed the proposed route of the Canal twenty-three times between Obispo and Gatun. It had twenty-six tributaries, and in the rainy season had been known to rise twenty-five feet within twenty-four hours. Could anything be harder to manage?

The Cordillera Mountains, or the divide between the oceans, were about five hundred feet above sea level at the highest point in the route of the Canal. The harbors on either coast were poor. Because of the shape of Panama Bay the tides on the Pacific coast rise twenty-one feet, while on the Atlantic coast they rise two and one half feet. In the rainy season a great amount of silt is carried

out into the harbors by the raging streams. All these were most serious problems for the engineer to overcome.

But this was not all. The constant rains and the peculiar formation of the rocks underlying the mountains caused many landslides that filled up the excavations almost as fast as they could be made. The labor problem was unusually hard, for, as we have said, the natives of the tropics will not work and the laborers brought in from the outside could not endure the conditions of climate, but sickened and died.

Aside from the many poisonous spiders and snakes, the excessive rainfall and the dense vegetation of the swamps make an ideal breeding place for myriads of mosquitoes, which have been proved to be disease carriers. It was a long time before people suspected that the dread yellow fever, that was almost certain to be fatal to foreigners, was carried from a sick to a well person by the bite of a certain mosquito.

By long and careful experimenting in the West Indies, the taking of grave risks, and the sacrifice of life, the responsibility was fastened on this small insect. The investigators first showed, by sleeping many nights in the bed and clothing of yellow-fever victims who had died, that the disease was not contracted by contact. Then, by careful observation, it was proved beyond a doubt that a certain kind of mosquito, called *stegomyia*, that bit a person suffering with yellow fever, could, after a few days, infect a well person with its bite.

Malaria also was spread from one person to another by another variety of mosquito, called *anopheles*. People who came in the early days contracted cholera from drinking the water and eating the fruit that grew wild.

Of course the idea of a sea-level canal pleased everybody best. A long, dug-out channel where boats might sail without interruption, and which would never grow too small for the largest ship that might ever be built,

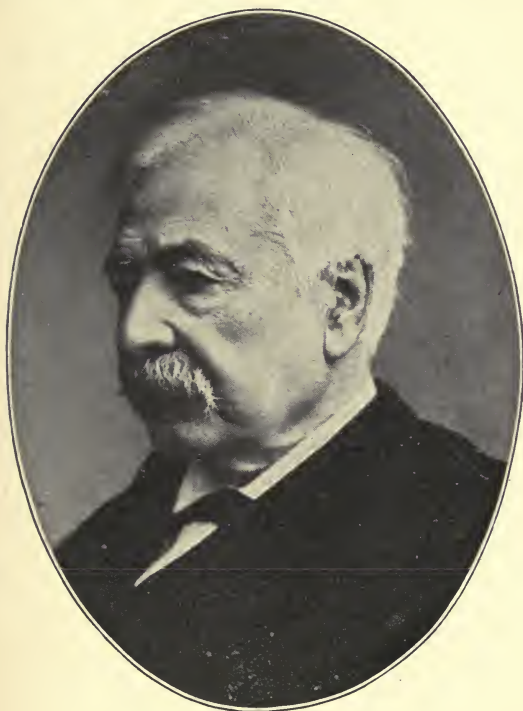
was naturally to be preferred. Many of the engineers argued that it would cost only a little more time and trouble to build the canal at sea level. On the other hand, the more thoughtful contended that it was easier to control the Chagres River by using it than by trying to make new beds for it and all its tributaries. They advocated the building of a dam across the valley where the Chagres flowed which would convert the river into a colossal lake lying eighty-five feet above sea level. By means of this and another small lake, made in the same manner, they proposed to lift the ships over the divide on a great "bridge of water." The boats were to be carried up to this higher level by means of immense water elevators, or locks, on one side of the divide and lowered by the same device on the other side to the level of the sea once more. This was known as the "lock type" of canal, or the lock plan.

DE LESSEPS' FAILURE

A COSTLY EXPERIMENT

WHILE the Panama railroad was in process of building, General Grant, with eighteen hundred soldiers, crossed the Isthmus on his way to the Pacific coast, losing eighty of his men with cholera on the trip. He was greatly impressed with the hardships of the journey, and was convinced of the benefit a canal would be to our country. One of the first things he did when he became President of the United States was to send to the government of Colombia, of which Panama was a part, to arrange for a right of way across the Isthmus. His messenger met with anything but a cordial reception at the hands of the Colombian government, so Grant turned his attention to the Nicaragua route. At this, Colombia gave to a French company the right of way the United States had been seeking.

A French company was organized with an immense capital, and Ferdinand de Lesseps



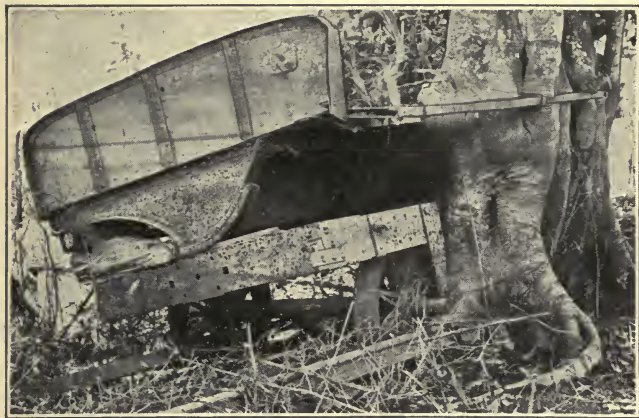
Brown Bros., N.Y., photographers
*Count Ferdinand de Lesseps, the famous builder
of the Suez Canal*

was chosen to build the canal. De Lesseps had but recently completed the Suez Canal,

which connects the Mediterranean Sea with the Red Sea, so every one had great faith in him. De Lesseps was more than seventy years old when he undertook the great task, but he was confident of his ability to do the work. The words, "The canal will be built," were ever on his tongue. Although many of the best engineers disagreed with him, he planned to dig a canal about twenty-nine feet deep, at sea level. He promised that it should be completed in eight years, and proceeded to let contracts for various parts of the job.

He pushed the work hard, but very soon the obstacles began to appear. The floods of the Chagres River which, as we have said, rises prodigiously in the rainy season, proved a factor he had not reckoned with. He had planned to get the river out of his way by building through the mountains a tunnel, ten miles long, which would carry it to the Pacific slope; but to change the course of this seething torrent with its numerous tributaries was

a mightier task than he dreamed. Slides again and again filled up his excavations at



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A dump-car, left by the French, imbedded in the trunk of a tree

Culebra Cut, and his men died by hundreds.

At last he was on the point of giving up the plan of a sea-level canal and turning to the lock type; but he had spent so much money and had accomplished so little that the company began to distrust him, and not enough money could be raised to proceed with new plans. He had built beautiful hospitals on the Isthmus to care for his men, but there

had been no attempt to prevent illness. It is said that out of every hundred men who came, only twenty were fit to work more than a few days. After spending \$260,000,000, and excavating about seventy million cubic yards of earth, de Lesseps was forced to throw up his hands and go back to France in disgrace. He lost his mind worrying over his failure, and died in 1894.

Some half-hearted attempts were made to continue the work, but the French company could not revive the interest in it sufficiently to raise funds to complete it. To keep the right of way, a few men were kept working on the line until it was sold to the Americans.

Much of the machinery used by the French was of use to the Americans in the beginning of their work. The hospitals and some of the houses built by de Lesseps were especially useful. The most important work that the French had done was between Gold Hill and Contractor's Hill, where the elevation of the divide is the greatest. They had

lowered the divide from three hundred and twelve feet to one hundred and sixty-one feet,



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Culebra Cut, showing Gold Hill on the right and Contractor's Hill at the left

removing about thirty million cubic yards of earth in the route that was of actual value to our workmen; but a large part of their excavations were of no use to us because our route was different from theirs.

The United States paid the French company forty million dollars for their rights, including the railroad. This also included their records and surveys, but since the French were unsuccessful, much of the work was gone over. After all, the greatest good we obtained from the French was the knowledge that made it possible for us to avoid their mistakes and profit by their experience.

PART II



COMING OF THE AMERICANS

"We own half of an unusually big waterfall at Niagara. We have some mountains out West which rival the Alps, and a bit of fine grain land in between. But we have never had an accomplishment like this Canal to boast of before. Something we as a nation have done ourselves—and not entirely for ourselves."

CLEANING UP THE CANAL ZONE

WAR ON DISEASE, THE FIRST GREAT TASK

DURING the Spanish-American War the battleship "Oregon," then stationed on our Pacific coast, was needed on the Atlantic. It took so long for it to make the ten thousand mile journey from San Francisco around Cape Horn that every citizen of the United States awoke to the immediate need of a canal at the Isthmus for the prompt and adequate protection of our coasts and the convenience of our navy.

After the war was over, President McKinley appointed an Isthmian Canal Commission of seven men, known as the I. C. C., to push the matter. Negotiations were again begun with Colombia, but when President Roosevelt took the chair there seemed to be little hope of their reaching an agreement. We were finally on the point of settling on the

88 *Panama and Its "Bridge of Water"*

Nicaragua route when Panama, which is credited with having had fifty-three revolu-



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Independence Day in Panama City

tions in fifty-seven years, rose once more against the Colombian government and declared its independence. The United States seized the occasion to escape further dealing with the leaders of the Colombian government by promptly recognizing the independence of Panama and making a treaty with her.

For a cash payment of ten million dollars and the promise of \$250,000 yearly after 1913, the United States obtained the control of the



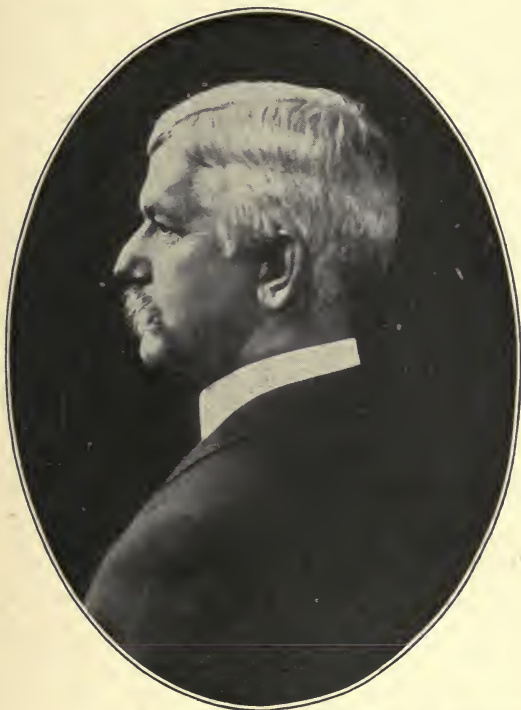
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*Gala day in the interior of the Republic of Panama. Panamanians greeting their
Presidential candidate on the outskirts of a town*

Canal Zone that we have before described. The French rights and the railroad were bought for forty million dollars and a new treaty was made with Great Britain. The new treaty of 1901 did away with the pledges of the treaty of 1850 and allowed the United States government to "construct, operate, and control a canal," with a free hand over the canal in time of war and the right of fortifying it as they see fit.

In 1904, the I. C. C., or the Commission appointed to dig the Canal, took charge of the Canal Zone. John F. Wallace was appointed chief engineer, George W. Davis, governor of the Canal Zone, and Colonel W. C. Gorgas was made head of the Health Department, which was to clean up the Canal Zone and make it a fit place to live in while the work of digging the Canal was carried on. At this time it was not decided whether the Canal should be built at sea level or after the lock plan.

Colonel Gorgas started in to do two things:

to clean up the cities of Panama and Colon, and to kill all the mosquitoes. He had had



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*Colonel William C. Gorgas, Chief Sanitary Officer
of the Canal Zone*

successful experience in this work in the West Indies and was a man admirably fitted

for the work. First of all, he understood the prejudices of the natives and knew how to handle them tactfully. It was said of him that "Gorgas can feed you liquid quinine and jolly you into thinking you like it." In the early days in Cuba there were many who made light of the war against the mosquitoes. Once one of Gorgas' superiors said to him:

"Is it worth while to spend all this money to save the lives of a few niggers?"

"That's not the point, General," replied Gorgas. "We are doing it to save *your* life, and *that* is worth while."

The Panamanians were slipshod and careless. They were immune to malaria and yellow fever, and those of the better class were accustomed to getting favors from their officers by means of bribes. But Gorgas turned every family out of its home for twenty-four hours while he fumigated the house. All the houses in the city of Panama were fumigated within two weeks, and he did it without opposition, by humoring and managing the people.

He built sewers and waterworks, and forced the residents of the city to connect the pipes that he laid underground. He also insisted on their disposing of all waste and garbage in a sanitary manner, instead of dumping it into the streets, as they had previously done. The large



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A sanitary drip barrel

stone basins standing in the courtyards, which had for many years held their supply of water, were a breeding place for mosquitoes. These were banished and a reservoir was made in the mountains twelve miles from the city of Panama, and from this the water was piped to all the houses. The streets were paved and a great stride toward sanitary living had been made. The same measures were used in Colon.

Then began the war upon the mosquitoes. Since the life of a mosquito is short, it was believed the quickest way of getting rid of

them was to prevent as many as possible from hatching. The mosquito lays her eggs on the top of stagnant pools or standing water. When the young mosquitoes or wigglers hatch they live in the water, but come to the surface very often for air. Kerosene was found to be fatal to the wigglers, so all the pools of standing water, and even some of the smaller running streams, were kept covered with a scum of crude oil, or "larvacide." After the rains this was constantly renewed by negroes with sprinkling cans. If the young mosquito gets a lungful of larvacide he never comes to the top again.

Attempts were then made to prevent the mosquito from depositing eggs, by destroying all the breeding places. Even the footprint of a cow in the soggy ground, after a few inches of water oozes into it, becomes a fine hatching place for the eggs of the malarial mosquito, and any small vessel standing outside through the rainy season may become a mosquito hatcher. That the sun might readily

dry up the puddles, hundreds of men were put to work with scythes or *machetes* to cut



Applying "larvacide" by the use of the knapsack sprayer

the grass and tropical growth. Swampy ground near the living quarters was drained or filled in, and every building was screened.

Mosquitoes of all kinds and sizes were caught and put into cages covered with every sort of netting until it was found which was the best mesh for excluding them. When

the new houses were built the architects planned them so that as little wire as possible was needed, for copper wire is the only sort that will stand the wet climate and a few feet more or less of this on the many houses made quite a difference in expense. It is estimated that it cost almost one million dollars to screen the government houses and other buildings in the Canal Zone.

The yellow-fever mosquito breeds only near houses, so this variety was easier to control. The health department saw to it that everything that would hold a few drops of water was gathered up, and it is laughingly said that if a mosquito was seen within the walls of a house the sanitary officer was sent for just as we would send for the police if we found a burglar.

While killing the mosquitoes did away with yellow fever, malaria still continued to be troublesome. Quinine was bought by the ton and shipped to the Canal Zone. Every employee was urged to take three grains a

day, and visitors had it served to them at meals at the hotels and on the boats entering the harbor. Vaccination of each person who came to the Canal Zone to live was insisted upon unless he could show a scar.

In every town or settlement there were government dispensaries, each with a physician in charge provided by the government, and a sanitary officer to inspect all houses and conditions of living. The French hospitals at Ancon Hill and Colon were renovated and furnished with all modern apparatus, and hospital cars were attached to passenger trains to take the sick there to be treated. A sick person was not allowed to remain at home except with the permission of the village physician. In this way epidemics were soon conquered. The physicians and nurses at the hospital were of the very best, so that every one had perfect care. At Taboga



*Mosquito whose sting
spreads yellow fever*

Island, where there is a sanitarium, the convalescents found delightful quarters.



*A general view of Ancon hospitals as seen from Tivoli Hotel,
Ancon*

In the first year an epidemic of yellow fever took thirty-seven Americans, but there have been few cases since then. It cost \$150,000,-000 to clean up the Zone, but during the last few years there has been a very small death rate. None but well persons were allowed to enter the Zone for employment or to remain, and those failing seriously in health were

sent back home, which perhaps explains, to some extent, the small number of deaths reported.

On the whole, health has been reasonably assured for the white man in a tropical climate if he is willing to live decently and healthfully, keeps clean, and leaves liquor alone. The people in the Zone not only learned many lessons of proper living but have taught them to the whole world. If under all the hard conditions of a new country it is possible to be free from flies and mosquitoes, we should certainly not allow ourselves to tolerate them in civilization.

THE GATUN DAM AND THE LOCKS

THE "STEPS" TO THE "BRIDGE OF WATER"

AFTER two and one half years of preparation, the work on the Canal began in earnest. President Roosevelt and Secretary of State Taft both lent their influence to the lock type of canal, which decided Congress in its favor, and in 1906 the I. C. C. began the process of damming the Chagres River. At Gatun, the valley of this river was about one and one half miles wide. By closing this space with a monster dam the river was forced to spread out into a mammoth lake one hundred and sixty-four square miles in extent, surrounded by a circle of hills. The lake reaches from Gatun to Obispo, where the Canal crosses the mountains, and provides twenty-three miles, or nearly one half, of the waterway of the Canal.

To build the dam, rock and earth excavated

at Culebra Cut were loaded upon cars, carried out on large trestles, and dumped in two long



Gatun upper locks, showing the various gates in course of construction

heaps, forming a double wall, seventy-five hundred feet long, across the valley. The space between these parallel walls of rock was then flooded with muddy water, and, when the mud had settled, the water was drained off, leaving a core of solid earth between the walls of rock. Thus was formed an artificial hill half a mile thick at the base.

102 *Panama and Its "Bridge of Water"*

This substantial, broad-based dam, when overgrown with green, looked so much like



The "spillway," Gatun Dam, looking south from the bridge

the natural hill formations surrounding the rest of the valley that it was hard to tell where the dam began and where it left off.

The water of the Chagres River can, at least once and a half times every year, supply this immense lake with water deep enough to be easily navigable so there is no danger of a dearth of water in this part of the Canal. To keep the surplus water from running over and washing away the top of the dam, the "spillway," a series of crescent-shaped openings,

lined with concrete and furnished with sluice gates, was built through the middle of

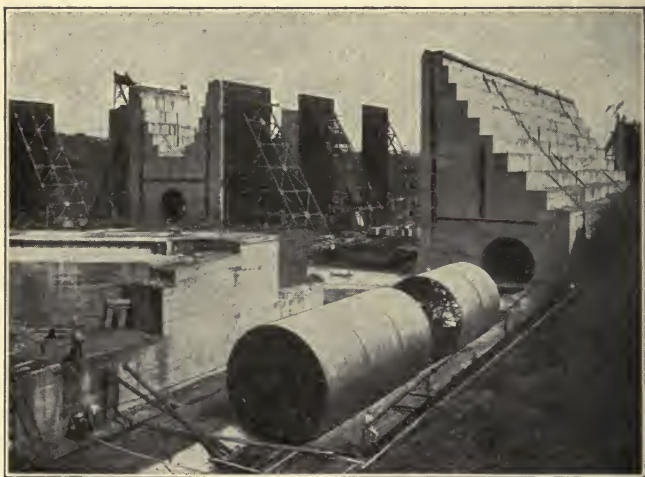


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The huge conductors which carry waste water to be transformed into power

it. It is arranged to hold back the water of the Gatun Dam in the dry season, and in the wet season to allow all of the extra supply to run off to the sea. However, our

government is thrifty enough to see that on its way this waste water is used to generate



A view of the concrete work in progress for the walls of the upper locks at Gatun

electricity for lighting the Canal and to furnish power to run the electric locomotives that tow the ships through the locks.

The locks at Gatun are gigantic concrete tanks, six in number, arranged in pairs. Each lock is big enough for a ship one thousand feet long, one hundred and ten feet wide, and with a draft of forty-five feet, to

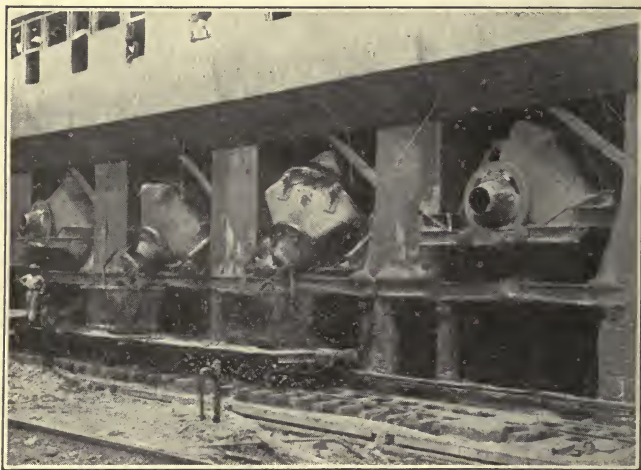
float in easily. If you can think of twenty fifty-foot lots in a row, you will see that it makes a very long block. If you can imagine nine-story buildings on both sides of a street one hundred and ten feet wide, in this long block, you can get some idea of the size of one of these immense locks.

The locks are arranged in pairs, as we have said, so that while one ship is going upstairs by means of the set of three huge steps, another ship may be coming downstairs on the other side. The locks are separated by thick walls of concrete and closed by steel gates.

The lock, or elevator, system cost fifty-eight million dollars. Mammoth concrete plants for mixing the concrete were erected at Gatun and Miraflores, and just as concrete walls are made on a smaller scale, so these gigantic pieces of masonry were built with carload after carload of the mixed cement which was dumped into the forms and tamped into place by laborers. The crushed

106 *Panama and Its "Bridge of Water"*

rock for making the concrete was brought from Porto Bello, twenty miles east of Colon,



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A concrete-mixing plant at Gatun Locks

and the sand was brought from Nombre de Dios, forty miles east of that city.

In each of the outside walls of the locks and in the center wall are tunnels eighteen feet in diameter which fill the locks with water when a ship is to be elevated to the lock above. Valves, operated by electricity, regulate the flow of the water. The gates for the locks

cost more than five million dollars, and the forty-six that fit out the twelve locks



International News Service

A steamer in the first lock, in which the water has risen

were made in Pittsburgh, Pennsylvania.

The ship climbs up to the great lake eighty-five feet above sea level in this way: The gates of the first, or lower, lock swing open and four electric mules, or locomotives, run out on the guide wall, fasten to the ship, and tow it into the locks, just as the real mules used to tow ships along a canal years

ago. No ship is allowed to enter the lock under her own steam, but is pulled through by the electric mules. When the ship is safely within the first lock, the gates are closed and the water comes in through the tunnels at the sides of the locks, filling the huge tank, and as it does so the ship is gradually lifted by the rising water to the level of the gates of the next lock, which is twenty-seven and one half feet above. This is nicely illustrated by placing a toy ship in a bathtub and seeing it rise to the top as the water is turned on to fill the tub.

Then the second pair of gates swings open and the electric mules draw the ship through into the second lock. In the same manner the boat is raised twenty-seven and one half feet higher in this second lock. In the third lock it is elevated thirty feet by the same process, and when released into Gatun Lake it sails out under its own steam eighty-five feet above the level of the sea. It takes less than an hour and a half for a boat to climb

these three steps. Every precaution, such as guard chains and inner gates, is taken to



International News Service

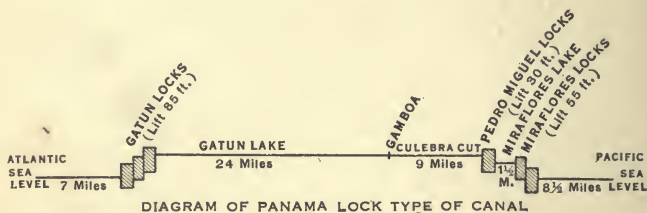
The first steamer starting on her trip through the Canal. At the left may be seen one of the electric towing locomotives

prevent the ship from bumping into the walls of the locks or ramming the gates.

To prevent misunderstanding of signals, which is the usual cause of accidents, one man will have charge of the guiding of the ship through the locks. Stationed on the middle wall, he will have before him a control-board with a model of the locks which shows the

110 *Panama and Its "Bridge of Water"*

exact position of the ship in the locks and of every fender and every guard chain. He



stands before this board and throws all the switches which open and close the gates and control the supply of water. Every motion of the ship is under his control, except the power of the electric mules.

Since only a few ships are so large as to require all the space furnished by the locks, arrangements are made so that more than one boat may be admitted into the lock at the same time, by intermediate gates which allow two small vessels to be elevated at once, thus saving power, water, and time. After sailing across Gatun Lake the ship has covered twenty-three miles of the journey, and then passes through Culebra Cut.

CULEBRA CUT AND THE SLIDES

A KNOTTY PROBLEM

NINE miles of the Canal, from Bas Obispo to Pedro Miguel, had to be excavated from solid rock. The deepest cut, at Gold Hill, necessitated going down two hundred and seventy-two feet. This channel is called Culebra Cut, and is at no point less than three hundred feet wide at the bottom; in some places it is one thousand feet wide. The French as we have said, had removed nineteen million cubic yards of dirt here, and their machinery was used the first year by the workmen from the United States. When serious work was begun by our country tremendous steam shovels were used, in this fashion: Compressed air drills dug deep holes. These were charged with dynamite, which was exploded by electricity while the men were gone to lunch or after working

hours. Small charges of powder were first set off in the drill holes to make them large



One of the big steam shovels loading rock at Culebra Cut

enough for the larger charges. Many boat-loads of dynamite, almost thirty thousand tons, have been used in the Cut; at one time as much as twenty-six tons were used to tear down an entire hillside.

The rock thus dislodged was gathered up in the large steel-lined dippers of the steam shovels, which are great machines weighing

one hundred and five tons. Some of the dippers of these great steam engines gobbled up as much as eight tons at one mouthful. They were then swung into position over the dirt cars and the load was dumped, ready for hauling away. Sometimes rocks lifted in this manner fell so heavily that the cars were broken when the load was dumped upon them. The contests between these steam shovels working in the Cut to see which would have the greatest number of cubic yards to its credit each day was like a great game.

To keep an empty dirt car always ready to receive the dipper loads in a cañon only three hundred feet wide meant an almost constant shifting of tracks. One clever man who was employed in the Zone invented a locomotive machine called a track-shifter. It has a crane that takes the rails and ties up bodily and places them to one side, three feet or more, as fast as a bed is made to receive them. It is operated by nine men and can do the work of five hundred men in a day.

114 *Panama and Its "Bridge of Water"*

Hundreds of men worked to change the tracks as fast as the steam shovels cut away



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A labor train arriving at Culebra station at the close of a day's work

the earth and rock. Even then it was impossible to keep the steam shovels busy more than six hours a day. There were seventy-five miles of track in the Cut, and some of it had to be shifted constantly. At the time the greatest amount of work was being done in the Cut, six thousand men were employed in the daytime, and about four hundred were kept busy at night to keep the steam shovels in repair, to refill their

coal bins, blast more material for the shovels, and anything else that might be done to further the work in the Cut in the daytime. The men were carried to the Cut from the various towns along the line by the labor trains.

From one hundred and fifty to one hundred and seventy-five trains, each made up of twenty-one dirt cars loaded with rock and earth, left the Cut each day. Some of this was used to build the walls of the Gatun Dam; much was used to fill in four hundred acres on the Pacific coast and to construct a breakwater at Balboa, while millions of yards were required for the fills in relocating the Panama railroad, and some of the loads were merely sent to the dumps.

In building the walls at the dam a wonderful system of procedure was carried out. The dirt trains ran out on tracks that were on the edge of the walls, and an unloading plow which swept the material down the bank was scraped over the flat cars by a steel rope. Spreaders were pushed over the new surface

thus built up and the track-shifter moved the track over to the new roadbed.

Rains interfered with the excavation work in the Cut. Work ceased during the worst downpours, but the Cut was dug at a slant so that the water ran off of its own accord. Rivers that crossed the line of the Canal were diverted by digging new channels for them.

Slides increased the time of the work in the Cut an entire year, for they carried as much dirt into the Cut as was taken out in the best year's record. Imagine the chagrin of the workers when they came one morning and found the Cut almost filled with earth by a slide that had occurred in the night!

The slides may be divided into two classes: gravity slides and deformation slides. The first are likely to occur in the wet season. They are layers of earth of porous material through which the water soaks, making a slippery layer between them and a harder layer of rock beneath all. The soapy, slippery

layer between the top layer and the hard layer beneath acts like a layer of ice on a



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Crevasses which precede the landslides

sloping surface, sending the top into the excavation with a movement like a glacier. Such was the Cucaracha slide that made the most trouble. It bothered the French, and

then was quiet for a number of years. In 1907 it started in the night and without



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A view of Culebra Cut, showing the Cucaracha slide

warning shot almost across the Canal opening, and for ten days kept up a glacier-like movement of about fourteen feet every twenty four hours. It filled the opening and piled up a mass thirty feet high on the west bank of the Cut. It threw nearly a million cubic

yards of material into the Canal, and the operation of dirt trains was delayed a month. In 1913 it carried two million five hundred thousand yards more into the Cut.

Deformation slides are due to unstable rock formations of very great depth. They are affected by the steepness and height of the slopes, and by the blasting. The underlying layer of rock is unable to support the weight above it, and it squeezes out sidewise into the bottom of the Cut like a mammoth tube of paste. Some of these slides filled up the bottom from fifteen to thirty feet. They usually occurred in the dry season and were absolutely unforeseen. One of them extended over an area of seventy-five acres, with ten million cubic yards of material to be removed, and another covered fifty acres, necessitating seven million cubic yards of extra digging. Altogether, the slides easily increased the labor of digging the Canal one fourth. They have, however, proved the foresight of the men who contended that we never could dig

120 *Panama and Its "Bridge of Water"*

a sea-level canal. When the blasting is done and the water presses continually on the



The "Ancon" passing through Culebra Cut near Empire at the official opening of the Canal

banks the engineers believe that the slides will give no further trouble.

The Culebra Cut is nine miles long, with a curve for every mile. It is, in fact, the only *real* piece of canal on the route, as the rest is river, lake, or bay adapted to the purpose. At the southern end of the Cut are the Pedro Miguel Locks, a single pair, which lower the

ships thirty feet to Miraflores Lake, formed by the Cocoli and other rivers, by a dam, and by the locks at Pedro Miguel. Miraflores Lake supplies a mile and one half of the Canal and conveys the ships to the Miraflores Locks, which are two pairs similar to the first two of the Gatun Locks. These lower the boats again to sea level.

Thus you will see that the Panama Canal is a "bridge of water" with three pairs of stairways, or steps, at either end of a chain of lakes and rivers. It takes, altogether, about three hours for a ship to climb up and down the locks and about ten hours to traverse the entire length of the Canal. Lighthouses, which are stationed at points of vantage from one end of the Canal to the other, furnish either electricity or gas, so that perfect light



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*A range light
on locks at Gatun*



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The completed Canal, near Empire, looking north toward the sharpest curve in Culebra Cut

is always provided for the route, night or day.

As we have said, the bays at both the Atlantic and Pacific entrances to the Canal were shallow and filled with silt by the rivers. Of course, neither was deep enough for the use of ocean steamers. Three methods of excavation have been used in digging the seven miles of sea-level channel on the Atlantic side and the eight miles on the Pacific coast. On the Atlantic side, steam shovels dug down to forty feet below sea level, while great dikes held back the water. The remainder of the work has been done by dredges, or "sand suckers," which are large-bodied boats that suck up the sandy water into their hulks, allow the water to drain off, and remove the sand to other points.

A deeper channel was provided on the Pacific coast, because of the high tides. Storms are not dangerous here, but the currents deposited so much silt in the channel that a breakwater was necessary. The Pacific breakwater runs from the mainland to the

islands three miles out in the bay. Fortifications are built here. Balboa, located on



Brown Bros., photographers

The Pacific coast breakwater—three miles of made land transported from Culebra Cut

built-up ground, is the real Pacific terminal of the Canal. Besides dredging the channel, the low ground, to the extent of about four hundred acres, near this point has been built up, or filled in, with rock and earth from the excavations and the dredging in the channel. A general equipment, costing twenty million dollars, for the future use of boats passing

through the Canal, is established at Balboa. There are machine shops, dry docks, wharves and warehouses, and further supplies of all sorts.

The breakwater in the Atlantic Ocean surrounds Limon Bay, and the forts are built at Toro Point. Steam dredges will be kept at work in both harbors to keep the channels clear.

NOTE.—On April 28, 1915, President Wilson signed a bill changing the name of Culebra Cut to Gaillard Cut in honor of the late Colonel D. D. Gaillard, engineer in charge of the Cut, who gave his life to the work.

HOW THE GOVERNMENT CARED FOR HER EMPLOYEES

THE "LABOR QUESTION" ANSWERED

THE money of the Panamanians is all in coin, or hard money, for no paper is used. By an arrangement with our government their standard coin, the *peso*, is recognized as half a dollar of our money. To distinguish between the skilled workers and the common laborers in the Zone the former were called "gold employees" and the latter "silver employees." All the Americans and other skilled workers were paid in American money, which is known as "gold," and the laborers from other nations were paid in Panamanian money, which is known as "silver."

More than forty nationalities were represented by the forty-five thousand persons living in the Canal Zone as employees. The Americans numbered about one sixth of the

population, they being the doctors, nurses, teachers, electricians, mechanics, masons, en-



Both faces of the "peso," the standard coin of Panama

gineers, and the heads of all supervisory work.

The colored laborer was most common, a great number coming from Jamaica and the other West Indies. The best service was rendered by the European laborers who came chiefly from Spain and Italy. It is said one Spaniard could do the work of two Jamaicans. Every nation in the world was represented in some capacity. It was commonly said: "In the Canal Zone you can stand on a corner and see the world go by."

Because of the great variety of names and nations and the fact that a large number

could neither read nor write their names, every employee was provided with a brass check, for identification, which he was required to present before he could draw his pay. The pay car went across the Isthmus once a month, taking three days for the trip, and the bank at Empire sometimes handled three million dollars a month. Out of the \$375,000,000 paid for the Canal, \$150,000,000 was paid for labor.

After the first two years of the occupation of the Zone the problem of providing food and merchandise for the employees was worked out in this manner: Everything was furnished by the government through a commissary department, whose headquarters were at Cristobal. The government had a laundry, a bakery which put out many thousands of loaves of bread a day, an ice-cream plant, an ice factory, cold-storage accommodations, and all sorts of merchandise. No cash sales were made at the commissary, but books of coupons containing from five to ten dollars'

worth of slips, each equivalent to from one to twenty-five cents, were issued to employees.



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Sunday market for Canal laborers at Pedro Miguel. The vendors spread their wares on the grass and many shrewd bargains are driven

The cost of these books was deducted from the employee's salary, and the slips were torn off and used as money by the commissary department, somewhat as we use books of ice tickets here.

Very early in the morning a special train with refrigerator cars left Cristobal with fresh supplies for all the towns along the line. Commissary wagons were waiting in each

130 *Panama and Its "Bridge of Water"*

town ready to carry the produce to the purchaser, who had ordered it the day before. Almost every luxury common in the United States was provided by the department. The meals served at the hotels were very much like those served in the United States, and, it is said, cost less.

In 1905 the Commission advertised free quarters to both married and single men. Aside from the rent, fuel and distilled water were also furnished free. Ice was delivered



Type of house built for four families by the United States Government. In the distance is the schoolhouse

and garbage was removed without charge. The houses were furnished, except for bed-

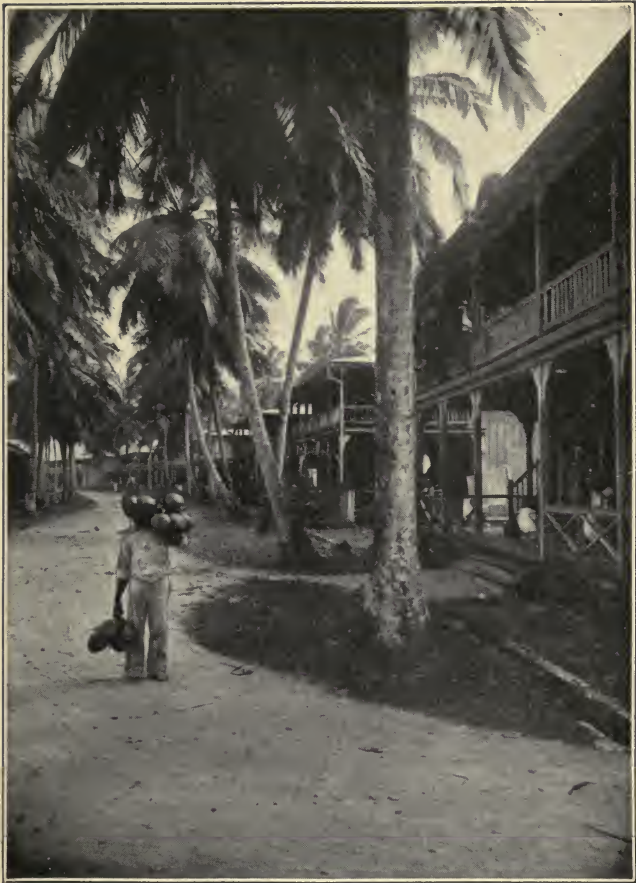


*Labor quarters built by the United States Government
throughout the Canal Zone*

ding and other personal belongings. This included electric lights and telephones; when they were needed for the man's work. These generous measures were taken to encourage home life in the Zone, because in the early days the men stayed so short a time on account of homesickness. A married man, under these conditions, could live as cheaply

as a single man, and when he had his family with him and was saving more money than he could in the States he was likely to be contented. At the best, however, the life was hard on the women who came, and those who were brave enough to conquer their longing for home and encourage their husbands in their work deserve much credit.

The houses built by the government were painted wooden structures, without plaster. On the outside they were all colored alike, a light drab, while the interiors were likely to be white or green. Some were single dwellings; others housed two, and some four, families. Quarters were assigned according to the size of the man's salary. Only thin clothing is used the year around in Panama, which allowed a great saving of expense in dress. The men often wore white duck for dress. Panama hats were not worn so commonly as one might think, for most Panama hats are not made in Panama, but in Colombia and Ecuador.



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*A street in Colon. Here are to be found the residences built
by the government for the officers of the Isthmian
Canal Commission*

The first public school was established in Panama in 1906. In 1912 there were forty-six white teachers and twenty-eight colored teachers in as many buildings. The sixteen hundred pupils and the teachers represented thirty-six different states. More than this, there were twenty-one different nationalities enrolled. The books and other material used were furnished free to the pupils, as was the transportation over the railroad to the high schools at Gatun and Ancon.

In the early days, before the commissary furnished the comforts of living in the Zone, a representative of the Y.M.C.A., Mr. A. Bruce Minear, was sent to the Isthmus to study the needs of the employees in the way of clean amusements. By mingling with the men, sharing their hardships, and gaining their confidence, he patiently worked to create a demand for the wholesome, manly recreations furnished by the Association.

Club houses were built by the government, under the direction of this organization,

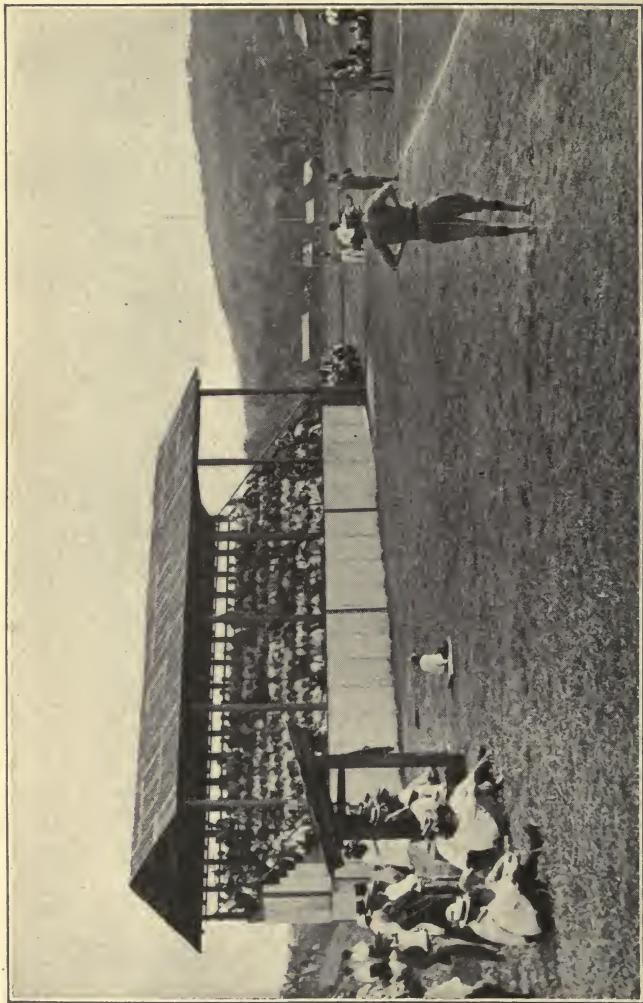
which furnished gymnasiums, libraries, club rooms for literary and social gatherings, and



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Manufacturing Panama hats. Here may be seen the fiber, hung up to dry and being used, the beginning of a hat, the cup, and several finished shapes

facilities for bowling, billiards, baseball, and other clean sports. Ice-cream parlors were a popular feature, and the club rooms were rented for dancing. It is impossible to say just how much this work did toward curing the homesickness and unrest in the Zone,



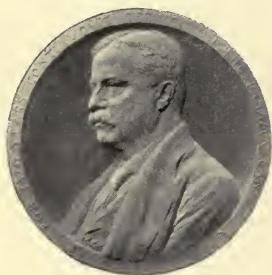
Copyright by Underwood & Underwood, N.Y.
A game of baseball at Culebra, Canal Zone, where it is as popular as in New York or San Francisco

but it is certain that it played a very important part in the building of the Canal. One official declared it did more than any other one department. The lonely man with a long evening on his hands found entertainment always waiting at the club rooms, whereas, before, he had no place to go but the saloon. Following this beginning of social life, church clubs, women's clubs, and lodges were organized. The government built Commission chapels and furnished chaplains, and in every way the life in the United States was duplicated as far as possible for the colony of people living far away from their friends and the opportunities for education and culture.

None of the employees had more than a ten-hour day and many worked only eight hours. There were two-hour intermissions at noon. Aside from free quarters, the men had first-class board cheaper than they could get it in the United States, and free medical advice and hospital care were furnished to

138 *Panama and Its "Bridge of Water"*

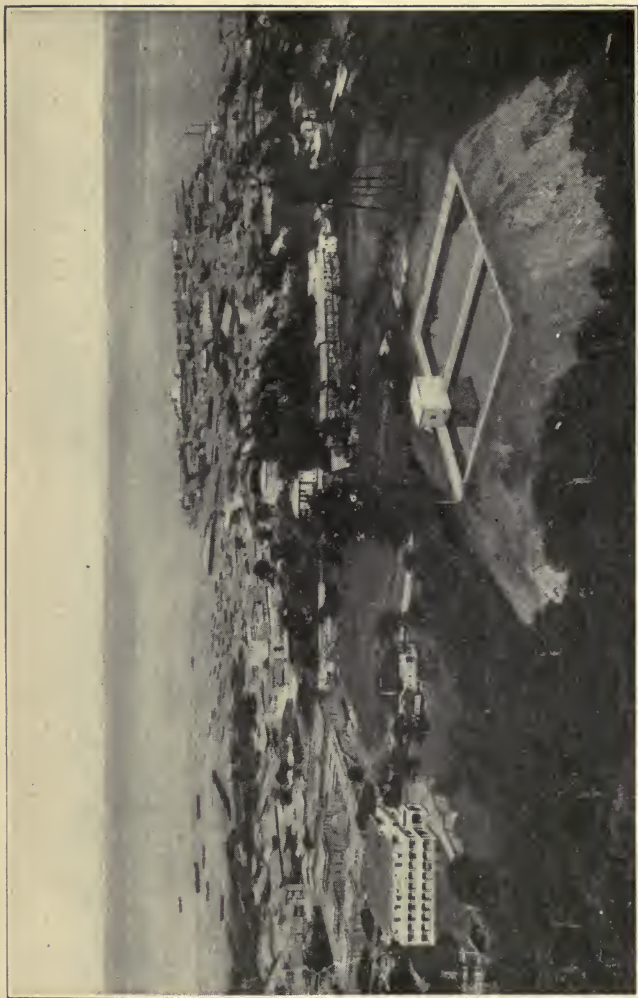
those who were ill. They had nine holidays on full pay, and an annual vacation of forty-



From Barrett, "Panama Canal: What It Is, What It Means"
*Medal given employees on the Canal "Gold Roll" for two
years of continuous service*

two days on salary. The Americans obtained reduced steamer rates to and from the United States.

In 1908, to further induce the men to stay until the Canal should be finished, a ton of copper, bronze, and tin, which was taken from old French locomotives and excavators, was shipped to the Philadelphia mint, where it was made into medals. These are about the size of a silver dollar, with a picture of Roosevelt on one side and on the other the picture of a ship sailing through Culebra Cut.



The city of Panama as it looks to-day from Ancon Hill

140 *Panama and Its "Bridge of Water"*

At the completion of the Canal about six thousand of these were due the employees who had earned them by working two years in the Zone. Those who had been there six years were honored by becoming members of the Society of the Chagres, which, it is said, will rank with the Grand Army of the Republic and some of the other national societies.

An attempt was made to survey roads for wagons through the Zone, with some notion of settling it when the Canal was finished, but so much of it is mountainous that there is little inducement to the Americans to try agriculture, and it was not thought desirable to settle the Zone with foreign colonists, because in case of war they might not be loyal to our flag.

So the towns along the route were abandoned. Gorgona and Empire removed parts of their repair shops to Balboa, and the site of Gorgona is now under the waters of Gatun Lake. Houses at other points were knocked

down and rebuilt at Gatun and Pedro Miguel, where they were needed to house the men



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A scene in Cristobal, Panama Canal Zone. At the right is Roosevelt Avenue and on the left, Columbia Avenue

who will operate the lights and the locks of the Canal. Cristobal and Balboa, at the entrances to the Canal, are the principal cities, and soldiers police the Zone, which is now a military reservation.

142 *Panama and Its "Bridge of Water"*

The city of Panama, which is nearly two hundred and fifty years old, has a population of fifty thousand. It is the capital of the republic and the distributing center for the Isthmus. The name means "plenty of fish." Spanish customs still prevail among the aristocracy. The business is largely in the hands of Chinese and Japanese. The men dabble in politics. The children of the well-to-do are sent abroad to be educated.



Charles M. Peacock, photographer

Harbor Market, Panama City, at low tide

Spanish architecture is found in the houses of the natives. The dwellings have red-tiled



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*A scene in Panama City since the coming of the street car.
So narrow are many of the streets that the passing
of the car blocks them completely*

roofs and are made of stone overlaid with colored stucco. The houses are built around a court, with the stairs leading to the second stories on the outside of the house. The people of the better class usually live in the second story. The Americans have greatly improved the city, with paved streets, water



The Cathedral, Independence Plaza, Panama

pipes, and sewers. The Panamanians were shrewd enough to know that by giving up their stone basins and some other customs they were adding to the value of their property, so they submitted to the new ideas with good grace.

There is a magnificent Catholic cathedral in the heart of the city, surrounded by the bishop's palace and by business blocks. Panama has a national theater where grand opera has a season once a year. There is street-car service now, but many of the tourists are still taken over the city in the victoria carriages for ten cents a ride.

One of the customs of Panama is the Sunday lottery. Tickets are sold all through the week, and every Sunday afternoon there is a drawing. The grand prize is seventy-five hundred dollars in silver, and the lucky winner has to have a cart to take so large an amount of money home.

The great celebration of the year is Independence Day, November 3, 4, and 5. For

146 *Panama and Its "Bridge of Water"*

three days business is at a standstill and festivities rule. A queen is elected by popular vote



Tillottson & Terrell

In Panama City there are many street venders offering curious and interesting articles for sale

and receives the homage of all. The people dance in the parks all night, and masquerade in picturesque costumes.

Already the higher social and business circles of Panama are adopting English, and the youth look to the United States as the land of their dreams. The Spanish Catholics are largely responsible for the Spanish

language and customs that prevail along the entire west coast of South and Central America. That religion is the religion of the people. In time, it is believed, the English language will be in equal use.

LEADERS IN THE PROJECT

THE MEN TO WHOM WE OWE THE PANAMA CANAL

THE greater part of the work of building the Canal was done during the administrations of Roosevelt and Taft. Taft, as Secretary of War, visited the Isthmus several times and arranged many diplomatic questions. Roosevelt was heart and soul in the enterprise from the beginning, and was much admired by the employees on the Zone.

When he visited the Canal at one time a large flag was hung across Culebra Cut in his honor bearing the words: "We are here to help." With his love for the rough life, Roosevelt enjoyed personally visiting every part of the construction and the excavation work. He shook hands with the employees and stood in line at their mess tents. When troubles arose on the Isthmus he sent Secretary Taft or a commission of

engineers to make a prompt investigation, and as fast as the forms of government would



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*Ex-president Theodore Roosevelt, to whose initiative is due
the Panama Canal*

permit he removed all obstacles at Washington that stood in the way of the work.

Although the reports of the greater number of engineers that Roosevelt had sent to determine the best kind of a canal to build stood in favor of the sea-level type, both Roosevelt and Taft used all of their influence to further the lock plan. It was because of this that a small majority was obtained in Congress in favor of the lock type. Later, Roosevelt stood out stoutly against the plan of letting out the work by contract instead of having it all under government control. Both these decisions proved to be most wise and of untold aid in the progress of the Canal.

When Roosevelt found that the first Commission of seven men was too slow in acting, he organized a new Commission and appointed a committee for action, the majority of which lived in the Canal Zone. When this proved unsatisfactory he chose an army officer as chairman of the I. C. C. with all other officers subordinate to him, and put him in complete control of all matters in the Canal



From Barrett, "Panama Canal: What It Is, What It Means"
Ex-president Taft and party inspecting work in the Canal Zone

Zone so that nothing should stand in the way of the prompt measures and quick decisions necessary to carry on the work as fast as possible. Taft was equally valuable in preserving pleasant relations with the Panamanian government and in settling money troubles and other affairs of state.

John F. Wallace was the first chief engineer appointed by President Roosevelt. In 1904, with Governor Davis and Colonel Gorgas, he went to the Isthmus, where he found only a narrow path through the jungle marked by the railroad, which was aptly described as "just two streaks of rust and a right of way." He found over seven hundred men at work with hand tools in Culebra Cut. His headquarters were at Panama in a building that once belonged to the French director-general.

Wallace repaired the railroad and rescued from the jungle fifty-eight locomotives and nine hundred and eighty dump cars that belonged to the French. But being a man

of large vision he soon saw that the tools then in use would never accomplish the work



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Ex-president William H. Taft, whose four years of faithful service carried forward the stupendous task at the Isthmus

before him, so he at once gave an order for nine immense steam shovels.

The houses left by the French were found to be inhabited by natives or buried in the jungle. He repaired three hundred and fifty of these and built others, until he had four hundred ready for the employees. These were by no means enough to accommodate the laborers that came.

To get things through the Commission at Washington meant great delay at first. Because the French had wasted money, the Commission felt it must proceed very carefully. Many things that were urgently needed were either refused by the Commission or delayed while they advertised for bids so that they might get them as cheaply as possible. This plan often delayed operations many months.

Considering the delay with which the Commission responded to the demands of Wallace—and of Gorgas, who was working hard to clean up the Zone—it is remarkable how much was accomplished the first year. Besides putting the houses in order, they

found a large dredge in excellent condition and put it to work in Colon harbor. When the jungle was cut away, machine shops covering several acres were found at Gorgona and Colon, and as soon as machinists could be secured they were put to work repairing the rolling stock of the railroad.

It required unusual courage to live on the Isthmus in 1904. The cities of Colon and Panama were wretchedly dirty. There was no ice, the food was poor, and drinking water had to be caught from the roofs. Insects made life miserable, and there were no baths. Powder boxes served as chairs, and other furniture was scarce.

Many workers who came to the Zone that first year returned to their homes by the next steamer. While the government was making every effort to get good men to go to the Isthmus, magazines and newspapers were publishing stories about the living conditions there that discouraged those on the point of going. Because the people were clamoring

156 *Panama and Its "Bridge of Water"*

to "see the dirt fly," Wallace kept a force at work in Culebra Cut when he should have been bending every effort toward the surveys that were to determine the plan to be followed.

Near the end of the first year the President reorganized the I. C. C., as we have said, and arranged it so that the majority of the acting committee lived in the Zone and were permitted to spend sums not exceeding a thousand dollars when it seemed necessary, without waiting to consult the rest of the



A street in Colon before the work of "cleaning up" the Canal Zone was begun. In the middle of the street was an open sewer

committee. Some other questions were settled, making it easier to get laborers and



The same street in Colon after the Sanitary Department had done its work

supplies, and, as living conditions were improving, things looked brighter. But just at this point two discouraging things happened. Wallace resigned, and yellow fever broke out on the Isthmus, taking the lives of thirty-seven Americans.

John F. Stevens was the next chief engineer. He was a splendid organizer, and, building

on the work already done, he accomplished a great deal in the second year. He solved the labor problem by bringing in the negroes from the West Indies and the still better laborers from Spain. He said that a railroad that could have nothing better said for it than that it never had any collisions was a failure. He pointed out the fact that it was better sometimes to have a few collisions, just to show that things were moving. He arranged a wonderful system of tracks and train service that kept the dirt cars always waiting for a load at Culebra Cut. At the end of a year after Stevens took charge, thirty-nine steam shovels were puffing in the Cut, there was a working force of twenty-three thousand men, the commissary was feeding the employees, and the lock canal was decided upon.

Stevens strongly favored the lock type of canal, which Wallace as firmly believed could never be successfully built because of the swampy land at Gatun, which he thought

would not support a dam. But in spite of the splendid progress Stevens was making, the political end of the job troubled him, and in January, 1907, he, too, resigned, to the great disappointment of the Canal workers, who were all very fond of him.

Then said Roosevelt: "Let us have a man who *cannot* resign." And he chose an army officer to succeed Stevens and placed the Canal Zone under military rule. George W. Goethals was experienced in building locks and dams. He had been a student and a teacher at West Point and was chief of engineers during the Spanish-American War. All officers on the Canal Zone were made subordinate to him.

Many of the men on the Isthmus did not like the idea of army rule. Since Stevens had been an unusual favorite, they were inclined not to like the new order of things. Goethals realized this, and won their favor by promising a fair hearing to every man with a grievance. He kept this promise by

devoting every Sunday morning to the people who wished to bring any trouble to his court. The poorest-paid laborer received as kindly consideration as the best-paid man on the job.

Some one who visited this Sunday-morning court tells these typical incidents:

"First appeared a colored man and his wife, who were squabbling over thirty-five dollars. Goethals listened to the tale until he found that the woman had earned the money washing; then he told the husband that if he wished to claim the money he would have to go back to Jamaica, where he would be under laws that would give the husband the right to spend his wife's money.

"A man who had lost a hand in some Zone machinery came to get damages. Goethals called one of his clerks and bade him fill out the papers for the sufferer.

"A cruel overseer was sent up for correction. His tale was heard, and he was duly warned against being a slave driver in the future, as they were not tolerated on the Zone.

“A negro who was not satisfied with his wages was obliged to face his own record in



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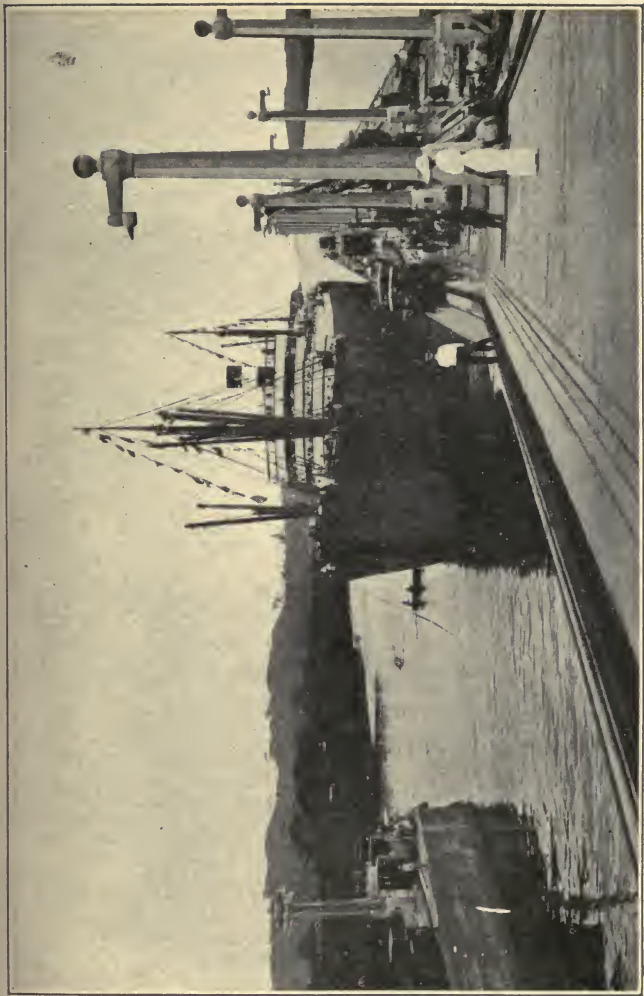
*Colonel George W. Goethals, formerly chairman and chief
engineer of the Isthmian Canal Commission, now Governor
of the Canal Zone*

black and white, the same sort of a record
as is kept of every employee on the Canal

Zone. Goethals figured that according to this report he was getting more than he was worth. When the negro threatened to appeal his case, the judge's eyes twinkled as he asked, 'To whom?' This sort of thing continued for several hours."

Goethals is a very hard worker. He spent the mornings on the works, his afternoons and evenings in his office, and his Sunday mornings holding court. He had at his finger tips every detail of the Canal construction. He accepted nothing but written reports from the men, and the words most frequently on his lips were, "Write it down." He always heard both sides of a question, and his decisions were final and, so far as he could conscientiously make them so, just. He had no vacation from the time he took charge of the work until it was finished, except an occasional necessary trip to Washington.

While it is entirely probable that Goethals could have done the work that the other chief engineers did, still we must not overlook the



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The steamer "Ancon" approaching Gatun Lock from the Atlantic end of the Canal, August 15, 1914, with Colonel Goethals, the "Man of the Hour" in Panama, standing on the lock walls directing the opening

fact that when he took charge of the enterprise it was comparatively smooth sailing. The problems of labor, construction, and living were all settled. It is doubtful, however, if any one could have completed the project with more economy, promptness, and smoothness than he has done.

Goethals generously says that no army officer could have organized Stevens' system for operating the railroad. And doubtless both Wallace and Stevens might have carried the work to completion had they been given Goethals' power.

President Wilson appointed Goethals governor of the Canal Zone, April 1, 1914.

Governors Davis and Magoon organized the schools and the police force, and improved other civic conditions before the Zone was put under army rule. Colonel Gorgas, who stayed on the Isthmus from 1904 until the Canal was completed, accomplished a task that was most unusual, and taught the whole world lessons of health and right living. He

has been made surgeon-general of the army. Engineer Gaillard, who had charge of Culebra Cut, gave his life to the undertaking. Engineer Sibert built the Gatun locks, and he and every member of the I. C. C. are deserving of all honor. Not only to the leaders who built the great Panama Canal, but to every employee who gave loyally of the best he had to the completion of the wonderful work that will mean so much to all the world, must we give due credit.

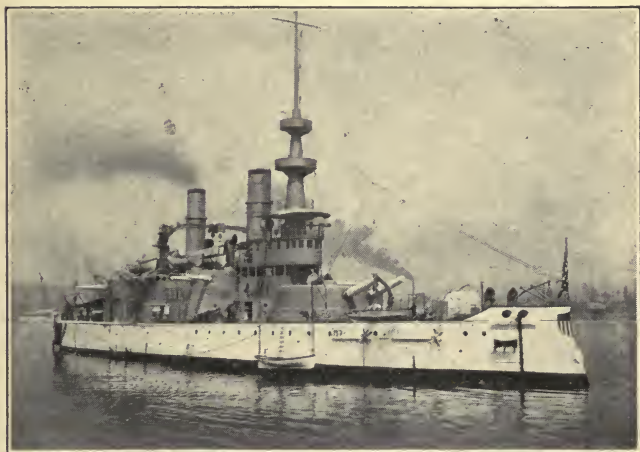
THE ZONE A MILITARY RESERVATION

HOW "UNCLE SAM" PROTECTS HIS INTERESTS

THE Panama Canal is now really a part of our seacoast. Therefore it is most important that the United States shall have entire control of it and its privileges. The Canal Zone is not under the Constitution but is governed by orders from the President and the Secretary of War, and by laws especially enacted by Congress. On the official seal of the Zone are the words: "The Land Divided—The World United."

Heretofore the distance around the vast continent of South America has prevented the enemy from attacking both our coasts at once. We have not a navy large enough to protect both coasts at the same time, so in case of war it might mean success to us to be able to use the Canal for the bringing together

of our fleet while we forced our enemy to use the long route to reach the other



The United States battleship "Oregon" which in 1915 could accomplish in eight hours the journey which in 1898 required a month

coast. Should we have war with two nations at once, one in the Far East and one in Europe, our possession of the Canal would force them to operate on lines eight thousand miles longer than ours.

Since in time of war we cannot trust to a treaty or a promise to protect us, we have carefully guarded our rights at the Isthmus

168 *Panama and Its "Bridge of Water"*

with fortifications. Protecting the Canal against the passing of an enemy's fleet is not a step toward war but a step toward preventing it. England owns a controlling interest in the Suez Canal, and by her fortifications excludes all powers from passage except for purposes of commerce. In order to keep her promise to protect the commerce of the Canal, the United States must keep entire control of the Zone.

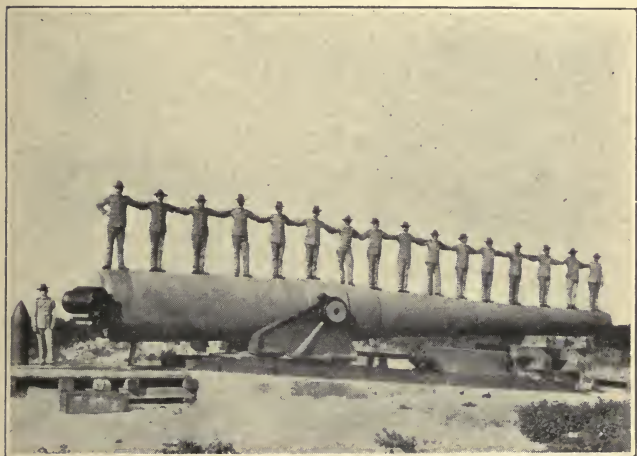
By building forts at the Atlantic and Pacific entrances to the Canal far enough



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The Pacific entrance to the Panama Canal

out to prevent the enemy's fleet bombarding the locks, we will make it necessary for the



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One of the big "16" guns to be placed among the fortifications which guard the Canal

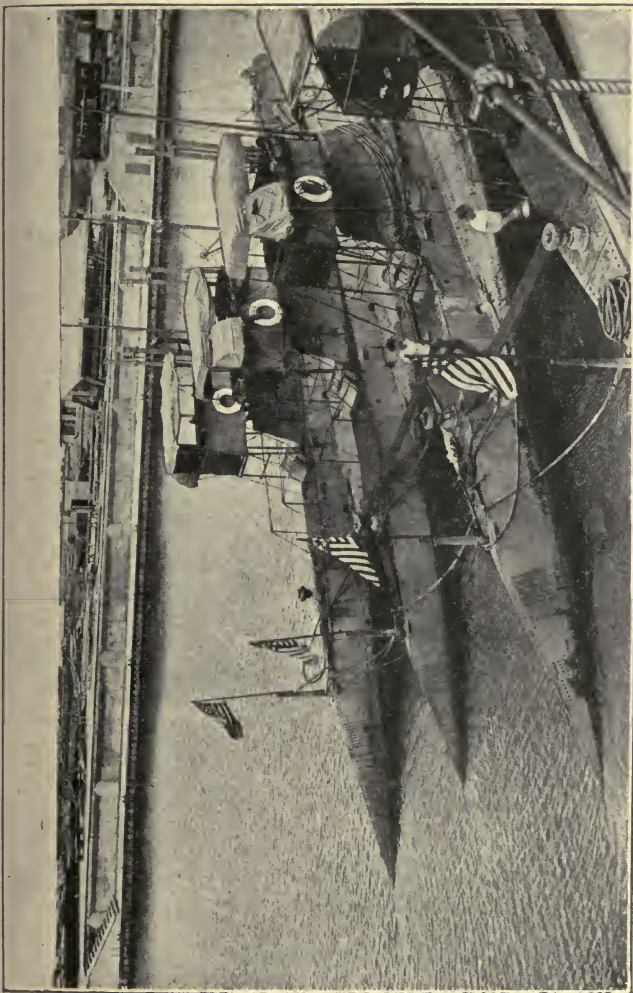
hostile fleet to land troops in order to do injury to the Canal. These outer fortifications not only prevent the bombardment of the locks, but they will enable our ships to get in line for action after passing through the Canal, where they would have to come out of the locks one by one. More than this, a seacoast artillery will prevent an enemy from

170 *Panama and Its "Bridge of Water"*

landing within a distance of six or seven miles from the mouth of the Canal.

But in spite of all these precautions, individuals or small parties may creep in and destroy some important work with explosives unless the garrison of the fort is constantly on guard against it. It would be a difficult matter for the marines or sailors from a hostile fleet to make a raid in the jungle. The greatest danger would result from an attack made by an army assisted by South American or Central American troops. Everything would be in favor of the men who best knew the conditions of the jungle and how to seek the enemy out in the swamps or to delay him until disease aided in his defeat.

The cost of the fortifications at Toro Point, in the Atlantic, and Flamenco Island, in the Pacific, amounted to more than twelve million dollars. The present garrison is composed of infantry, with a small force of cavalry for use as scouts and patrols. The latest and largest disappearing rifles are in use. The



Four of the five submarines which are to guard the Pacific entrance to the Canal, anchored at the new concrete docks, Colon

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172 *Panama and Its "Bridge of Water"*

Atlantic entrance is better guarded than the Pacific, but at present there is more danger of attack here. The base of supplies we have established in the Hawaiian Islands would be an aid to the Pacific garrison. If a serious attempt were made to capture the Canal and to hold it against us, the garrison would have to be speedily reënforced.

To this end, the Navy Department has selected a site for a wireless station near San Pablo, twenty miles inland from the Atlantic, on the east side of Gatun Lake. This station is on an elevation one hundred and ten feet above the lake level. It can send a message three thousand miles, and can communicate with Washington or a similar station on the California coast. Smaller stations are at Colon, Balboa, and Porto Bello.

The soldiers police the Zone, permitting entrance to no one who is hostile to our nation. Vessels may coal at Colon or Balboa and secure fresh provisions. Repairs may be made and cargoes handled promptly.

With all these provisions for the convenience of passing steamers it will not be necessary



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View of the reservoir and wireless station at Porto Bello

for other nations to establish like facilities in the Zone. Ice plants, cold storage, and other commissary aids have long been on the Isthmus, and our nation can supply coal cheaper than any other could. In fact, the difference between the cost of coal at Panama and at Suez, it is said, will go far toward the paying of the tolls through the Panama Canal.

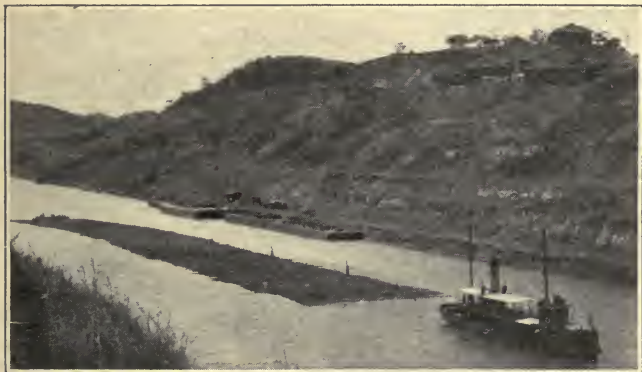
THE CANAL AS A COMMERCIAL HIGHWAY

HOW IT PROMOTES OUR TRADE

BUT it is for peaceful purposes rather than for military uses that the United States hopes to use the Canal. The primary object in its building was to promote domestic trade, or commerce between our two coasts. Already the United States does a larger coastwise trade than any other nation in the world. Heretofore the products of the western coast have been brought to us in three ways: by sailing with them around Cape Horn; by bringing them across the Isthmus by way of the Panama railroad, or by the Mexican railroad across Tehuantepec; or by one of the transcontinental railroads across the United States.

Before the Canal was finished a certain tug and three barges lying on the Atlantic

coast were needed at Balboa, the Pacific port, only forty-seven miles away. One way



Universal Photo Service, Chicago

First commercial use of the Canal. Towing piles to Atlantic side for breakwater. Scene opposite the village of Culebra

to get them there was to take them to pieces, send them across by railroad, and rebuild them on the other side; the other was to take them around Cape Horn. The journey of 10,500 miles around South America took over four months; had the Canal been finished, it might have been made in ten hours.

Now San Francisco, Seattle, and Portland may place their products in our Atlantic ports with a great saving of time and expense.

San Francisco, by way of Cape Horn, was fourteen thousand miles from New York; it is now a little less than five thousand miles, or a trifle more than one third of the former journey by water. Wheat, wines, barley, hops, dried fruits, and mining products may be brought to the Gulf and Atlantic ports much more cheaply than by the railroads crossing the United States. It is estimated that the cost of shipping from the western coast to the eastern will be reduced one third.

Machinery, manufactures, and other finished products of the Eastern states may be sent to the Pacific coast at a lower cost. Iron can be purchased more cheaply in Alabama than anywhere else in the world. The Tennessee mills produce machinery and the Southern states center a large share of their manufactures on the steel and hardware business. The states and countries on the Pacific coast are anxious for these products.

It is predicted that the next generation will see ocean steamers sailing down the

Mississippi from Duluth en route to San Francisco by way of Colon. This will give a great impetus to the manufacturing of cotton and iron in the valley of our great river and the heart of our country which has hitherto been shut off from coast trade. By means of the Canal, the East can get hold of the western lumber that it so much needs, and the East will exchange, besides machinery and manufactures, much coal for the grain, lumber, and sugar from the West.

In 1907 the American-Hawaiian line of steamers shifted from the Panama railroad to the Mexican line crossing Tehuantepec while the Canal was being built, because they could get prompter service. In six years the cargo tons had doubled and the sugar tonnage from Hawaii to the eastern coast of the United States made it necessary in 1911 to order five new steamers. Since they have been obliged to hand over to the railroad company about one third of their profits for shipping, the Canal will prove a great boon to them.

178 *Panama and Its "Bridge of Water"*

The United States has been so busy farming, mining, manufacturing, and exchanging



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These five submarines, with a collier and the monitor "Montauk," voyaged from Guantanamo, Cuba, to Colon, Panama, the longest journey on record for a submarine

its products among its own states that it has only recently arrived at the point where it desires to have its share of commerce with other nations. Some of the South American countries are becoming great nations, and the United States is anxious to secure a larger share of their trade. We are likely

to forget that South America lies east of the greater part of North America, which makes it nearer to Europe than to the United States. European nations have secured almost all of the South American trade. They have studied the needs of these countries and have learned many ways to obtain their favor. England and Germany send men who speak the Spanish language to secure business from these nations. They pack their merchandise in small boxes that can be easily carried over the mountains. Four fifths of the nitrate shipped from the coast of Chile goes to Europe, and only one fifth to the United States. Most of the Chilean grain also goes to Europe. South America spends eighty-six million dollars yearly for cotton, but only five per cent of this is bought from the United States. Our cotton will soon be used in preference, for we can supply them more cheaply now, because of the Canal. It is believed that the great European War will also turn much of this South American trade to our markets.

The distance between our eastern coast and the Philippines by way of the Suez Canal is not greatly reduced by the Panama Canal. We shall, however, be able to call at the ports of Hongkong, Yokohama, and San Francisco on our way, gathering much trade en route to the Philippines. The cost of fuel will be less, and by being able to obtain a fresh supply of coal at the Isthmus the vessels will be able to take a larger cargo, as less space will be required for fuel. Our Atlantic seaboard will be brought four thousand miles nearer to Australia and New Zealand. These countries have a large export trade in wool, hides, and other material, which the United States should share with England. Trade with China and Japan will now reach the eastern coast of our country as well as the western.

Congress has authorized a maximum freight rate through the Canal of \$1.25 a ton and a rate of \$1.50 for every passenger who passes through. All ships are subject to the same

rules, because the United States promised that the Canal should be open to all nations on equal terms. However, the warships belonging to our government are privileged to pass through without paying toll.

It may be several years before the Canal will be able to earn the fourteen million dollars a year necessary to support it. It requires twenty-five hundred men as an operating force at a cost of four million dollars a year, besides the interest on the investment. The Suez Canal pays for itself every four years, but it cost much less than the one at Panama.

THE PANAMA-PACIFIC EXPOSITION

AMERICA'S TRIUMPHAL CELEBRATION

THE Panama-Pacific Exposition held in San Francisco in 1915 is in honor of the union of the Atlantic and Pacific ocean traffic. San Francisco was chosen for the site of the Exposition because it is our oldest city of size and prominence lying on the Pacific coast and facing the countries of Asia.

It has a fine harbor—the one most suitable for the great sea event planned to celebrate the opening of our new waterway. This harbor is surrounded by hills, forming on the ocean front a beautiful amphitheater of great size.

The grounds of the Exposition comprise a tract of six hundred and twenty-five acres on partly sloping ground extending two miles along the harbor where the sea-going ships pass. A wide esplanade extends along the

water's edge, furnished with seats, from which displays on the ocean may be seen.



Universal Photo Service, Chicago

*The Palace of Education, one of the many imposing buildings
of the Panama-Pacific Exposition*

The temperature in San Francisco is often suddenly changed by the cold sea winds that are unpleasantly strong where the sweep is unbroken along the harbor's edge. As a protection from this a wind barrier has been built. It is a giant sea wall, sixty feet high, facing the ocean, and gives the Exposition grounds an appearance similar to that of the

walled cities of France and Spain. The wall is pierced along the harbor frontage by three gateways which lead into the interior courts. One of the gateways is called Columbus, and one of the others, Balboa.

Mr. Jules Guerin, who made the plan of the Exposition, gave special attention to color. Because the residence portion of San Francisco is on the hills above the grounds, the buildings were designed with much thought to the roofs. The Chicago World's Fair was all in white. Looking down upon the Pacific Exposition grounds the design and effect is that of an immense Persian rug. The pillars, statues, fountains, masts, walls, and flagpoles are all in rich ivory yellow. In order to have everything in harmony, Mr. Guerin himself personally superintended the dyeing of the bunting for the flags and draperies. The domes are in gold, the roofs of red tile, and the minarets of copper green. The courts are filled with greens and flowers, all adding to the warm, bright hues.

Aside from the usual displays in the state buildings, some of the foreign countries have



Universal Photo Service, Chicago

The Palace of Horticulture, with its great dome rising almost two hundred feet, is one of the most beautiful and remarkable buildings of the Exposition

wonderful exhibits. There is a large live-stock exhibit with generous premiums. The aviation and race track meet is a new feature in world expositions.

Among the attractions in the "midway" is a working model of the Panama Canal,

186 *Panama and Its "Bridge of Water"*

large enough to send two thousand people through the locks every twenty minutes.



Universal Photo Service, Chicago
*The official seal of the
Panama-Pacific Exposition*

There is also an exhibit of every kind of machinery used by the French and the Americans in the thirty-five years of construction work from 1880 to 1915.

Mr. W. D. A'Ryan, who had charge of the lighting of the Canal, has charge of the lighting of the grounds and buildings. At Chicago, arc-lights on posts were used; at Buffalo, outline lighting made all the buildings of the Pan-American Exposition beautiful, but at San Francisco the indirect method of lighting is used. All lights are concealed in the colonnades or masked batteries, and the reflected rays give a wonderful imitation of daylight.

A great exposition is now looked upon as a means of education for all nations, especially in the way of art. Many deserving artists

have been brought to notice and favor by their work at these public fairs. Each court of the "walled city" has been treated differently by a different architect, and the whole is adorned by large mural paintings and groups of sculpture by different artists.

Thousands of Americans are going through the Canal on their way to the Panama-Pacific Exposition, making a cruise from New York of eighteen days.

Every difficulty has been overcome, and the work of making the Canal a success is full of glory and achievement. It is fitting, therefore, that we, as a nation, "rejoice in the courage, the persistence, and the indomitable ability that have finished the great work in Panama." "The Land Divided—The World United" is truly a fitting seal for the wonderful "Bridge of Water."

A GUIDE TO PRONUNCIATION

The following key explains the symbols used to indicate the pronunciation of the words in THE GLOSSARY. It is based on the latest edition of Webster's New International Dictionary.

ā.....	as in āle
â.....	as in senâte
ă.....	as in ăm
ǎ.....	as in finǎl
ä.....	as in ärm
à.....	as in àsk
â.....	as in sofâ
ē.....	as in ēve
è.....	as in crèate
ě.....	as in ěnd
ẽ.....	as in cinděr
ī.....	as in ĭce
ĩ.....	as in ĭll
ō.....	as in ōld
ò.....	as in òbey
ô.....	as in lôrd
ö.....	as in ödd
oo.....	as in fôod

THE GLOSSARY

- Balboa (bäl bō'ä)
Bas Obispo (bäs ô bēs'pō)
Bocas del Toro (bō'cäs děl tō'rō)
Caribbean (kär rīb' e àn)
Ceron (sē rōn')
Chagres (shä'grēs)
Chiriqui (chē'rē kē')
Cristobal (krīs tō' bäl)
Cocoli (ko ko lē')
Colon (kô lōn')
Cortés (kô'r'těz)
Cucaracha (koo kä rä'chä)
Culebra (kōō lā'brä)
De Lesseps (dě lě'sěps')
Flamenco (flô măn'kō)
Gatun (gă tun')
Goethals (gō'thălz)
Gorgas (gōr' gäs)
Guatemala (gwä'tă mǎ'lă)
Guerin (gěr'in)
Hawaii (hă wī'ē)
Jamaica (jă mǎ'kă)
Limon (lě mōn')
Magoon (mă gōōn')
Minear (mī nēr')
Miguel (mē gěl')

- Nombre de Dios (nōm'brā dā dyōs)
Panama (păn'ā mā')
Panamanian (păn'ā mǎ'nǐ ǎn)
Pedro Miguel (pē'drō mē gēl')
Pizarro (pǐ zār'rō)
Rodrigo Bastides (rōd rē'go bās tē'dās)
Saavedra (sǎ'ā vā'drā)
San Blas (sǎn blās)
San Pablo (sǎn pǎ'blō)
Sibert (sē'bērt)
Tehuantepec (tǎ wǎn'tǎ pěk')

SUGGESTIONS TO TEACHERS

THIS story of Panama may be used for history teaching, alone, or for its value in geography. It may be used for story-telling, or for topical recitation to develop language power. The author feels the value of solving problems in the classroom and has tried to keep in the foreground causal relations that will stimulate thinking. There are scores of opportunities for the question "Why?" or "How?" Let us bear in mind that one of the most important aims of the school is to make our pupils think; that is, reason empirically from the points suggested to their own conclusions. Good reasoning and the careful judgments which naturally follow are the highest proofs of intellectual power.

It will lend interest to geography teaching if you will encourage pupils to think out the contents of cargoes passing through the Canal after giving the port of clearance and the destination of the ship.

A profitable week might be spent in comparing and contrasting the Panama Canal with the Suez, the Welland, the "Soo," the Kaiser Wilhelm, and others, as to construction, length, amount of traffic, and other points.

Pupils will be greatly interested in making a toy or miniature canal, and such time is well spent since ideas of canal construction become more

clear. They will also enjoy a drawing lesson on the Canal, showing a side view with the locks at either end, and the long water bridge.

It will be illuminating to the children to allow them to figure out the differences between distances over the old ocean routes and those by the new routes through Panama, as well as the time saved, the ship's speed being placed at twenty miles an hour. The distances are given in the following tables.

DISTANCES VIA PANAMA TO WESTERN PORTS OF AMERICA
FROM LIVERPOOL, NEW YORK, AND NEW ORLEANS¹

VIA PANAMA TO	FROM LIVER- POOL	FROM NEW YORK	FROM NEW ORLEANS	ADVANTAGE OVER LIVERPOOL	
				New York	New Orleans
Valparaiso.....	7,207	4,633	4,054	2,574	3,153
Iquique.....	6,578	4,004	3,425	2,574	3,153
Callao.....	5,937	3,363	2,784	2,574	3,153
Guayaquil.....	5,384	2,810	2,231	2,574	3,153
Acapulco.....	6,017	3,443	2,864	2,574	3,153
Honolulu.....	9,276	6,702	6,123	2,574	3,153
San Francisco...	7,836	5,262	4,683	2,574	3,153
Portland.....	8,486	5,912	5,333	2,574	3,153
Port Townsend .	8,606	6,032	5,453	2,574	3,153

DISTANCES FROM NEW YORK, NEW ORLEANS, AND LIVERPOOL
TO PRINCIPAL PORTS OF EASTERN ASIA AND OCEANIA¹

To	New York via Panama	New Orleans via Panama	Liverpool ² by Shortest Route
Yokohama.....	9,798	9,219	11,678
Shanghai.....	10,649	10,070	10,607
Hongkong.....	11,691	11,112	9,785
Manila.....	11,548	10,966	9,701
Melbourne.....	10,028	9,427	11,654
Sydney.....	9,811	9,232	12,235
Wellington.....	8,540	7,939	11,975

¹ The distances are in nautical miles.

² Via Suez, except to Wellington via Strait of Magellan.

The teacher should keep in mind, however, that distance is not the only factor in determining ocean routes. Ocean currents and prevailing winds have some effect. The location of coaling stations is important, as well as the quality and cost of the coal used. One of the main considerations, however, is the supply of freight at both termini of the route and at the way stations where additional freight may be obtained. The interchangeability of freight is perhaps the most important factor of all. If both termini of a route have a surplus of the same products, there is no use in shipping them from one to the other. Most of the sections coming within the sphere of the Panama Canal have products that are interchangeable. For example: The western coast of South America offers a surplus of natural products. Chile has nitrates, copper, and very small quantities of wheat and other grains. The nitrates are needed by both the United States and Europe, and the copper comes to the United States to be smelted and refined. In exchange for these Chile takes food supplies and manufactured goods, and both the United States and Europe have manufactured articles for sale in great quantities. The Philippines and the East Indies also have a surplus of sugar, tobacco, hemp, and other tropical products, while both Europe and the United States want these articles, and are glad to ship back manufactures in payment for them. And it is these manufactured commodities that the oriental countries want.

Distance, then, may be a minor consideration in

determining ocean routes. Steamships must adjust their business to the needs of commerce. A steamer which carries wheat, corn, and meat from Argentina to Europe may bring the silks, woolens, and laces of Europe to the United States and then return to Argentina with agricultural implements and iron and steel manufactures from our country. There are many such triangular routes of commerce.

The youthful mind is perhaps more easily interested in the deed than in the characteristics of the man who performs it. Still we believe that this story offers a fine opportunity to contrast a number of strong and unusual characters and to study the motives that actuated these men in accomplishing a great result.

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